UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

22 April, 1987

MEMORANDUM FOR: F/M11 - Richard B. Stone

FROM: F/M1 - Peter H. Fricke Peter Fricke

SUBJECT: Review of Draft Amendment 11 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan

I have reviewed the above draft amendment as requested, and have the following comments to make.

The DAP priority within 100 miles of Unalaska: This is a well organized section which tries -- and mostly succeeds -- to make sense of the issues involved. It falls down because, with the exception of direct processor employment, it does not describe the potential costs and benefits to fishermen and shore-workers. The draft notes that there is little data available. However, the Social and Economic Studies Division, Alaska OCS Regional Office, Minerals Management Service commissioned a detailed study of potential impacts of changes in the fishing industry in Unalaska and Cold Bay. This study, undertaken in 1983 and 1984,was published by Westview Press in 1985 and reviewed in my FSSN letter of April 28, 1986. Since this is a domestic allocation issue which is largely tangential to conservation matters, the Council should beef up their rationale for allocation to ensure compliance with national standards 2, 4 and 5. In particular the effects on Native employment (and Native entities such as the corporations), potential for development for a stable economy in Unalaska Island, and local extraction of "rent" from the fisheries need to be fully detailed. Given this, almost any one of alternatives would be acceptable if the impacts were fully described. The concentration of JVP efforts on the winter/early spring fishery is the one area of conservation concern which the draft raises, and this needs to be examined in any of the alternative proposals to ensure that adequate spawning occurs.

Revise the definition of prohibited species: This should have no social impact other than improved fishing practices.

Improve catch recording requirements: The socioeconomic analysis is full and the alternatives are adequately described and considered.

Revise the definition of ABC: The discussion, although brief, describes the economic impacts on the fishery, and provides adequate information for a decision.

The proposal to increase the upper value of the OY range is less clear; basically because impacts are couched in total catches and average ex-vessel values. This needs some more information before an informed judgement on social impacts can be made.

Pollock roe-stripping: The information is not clear, but the issue begs the question of "in the benefit of the Nation". Increased use of the resource and the benefits to the public of full use need to be addresses but are not.

cc: F/M1 - RBRoe

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

APR 20 1987

MEMORANDUM FOR: Distribution*

FROM: F/M11 - Richard B. Stone

SUBJECT: Review of Draft Amendment 11 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan

The North Pacific Fishery Management Council has prepared the proposed Amendment 11 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan discussed in the attached draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis. Please note the discussion and analysis on the proposed measure to establish a priority access area around Unalaska Island (page 2-1) is referenced in the Gulf of Alaska Draft Amendment 16, sent to you on April 17.

The Council has requested an accelerated review because it intends to adopt the final Amendment at the May meeting. Please provide your review and comment by April 29, 1987. If you have any questions, please contact Don Leedy at 673-5272.

Attachment

*Distribution

[redacted] - Roe, [redacted]
F/M5 - Pallozzi
F/M11 - Surdi
F/M12 - Jackson
GCF - Cooney, Luipold
GCEL - Frailey
F/PP - Everett
F/M3
F/M41 - Karnella
F/M42 - Rublemann
F/S1
PP2 - Cottingham
OGC - Malone, Moran
GC - McGovern

North Pacific Fishery Management Council

James O. Campbell, Chairman
Jim H. Branson, Executive Director

411 West 4th Avenue
Anchorage, Alaska 99510

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Anchorage, Alaska 99510

Telephone: (907) 274-4563
FTS 271-4064

April 15, 1987

Dear Reviewer:

The North Pacific Fishery Management Council requests your comments on the enclosed proposed Amendment 11 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan, which addresses the following issues:

(1) DAP priority within 100 miles of Unalaska Island.
(2) Revise the definition of "prohibited species".
(3) Improve catch recording requirements.
(4) Revise the definition of acceptable biological catch.
(5) Increase the upper value of the optimum yield range.
(6) Prohibit pollock roe-stripping.

Each issue has several proposed alternative solutions and their environmental and socioeconomic impacts are discussed in the accompanying Draft Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA). This analysis was prepared by members of the Bering Sea/Aleutian Islands and Gulf of Alaska groundfish plan teams and Council staff.

The comment period began on April 15 with the distribution of the amendment's revised Notice of Availability. All written comments should be received at the Council office by 5:00 p.m., Monday, May 15. Oral testimony will be allowed during the Council's meeting in Anchorage, scheduled for May 20-22. The Council then will adopt a preferred solution for each of the six issues above and forward their recommendation to the Secretary of Commerce.

If you have any questions concerning the proposed amendment or its supporting materials, please contact Denby Lloyd, (907) 274-4563.

Sincerely,

Jim H. Branson

Jim H. Branson
Executive Director

Enclosure

BSA6/AG-1

D R A F T

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/
INITIAL REGULATORY FLEXIBILITY ANALYSIS
OF AMENDMENT 11 TO THE FISHERY MANAGEMENT PLAN FOR
GROUNDFISH OF THE BERING SEA/ALEUTIAN ISLANDS

PREPARED BY THE PLAN TEAM FOR THE
GROUNDFISH FISHERY OF THE BERING SEA/ALEUTIAN ISLANDS
AND THE STAFF OF THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

APRIL 15, 1987

TABLE OF CONTENTS

1.0 INTRODUCTION

The domestic and foreign groundfish fisheries in the Exclusive Economic Zone (EEZ) of the United States (3-200 miles offshore) in the Bering Sea and around the Aleutian Islands are managed under the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area (FMP). The FMP was developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act). It was approved by the Assistant Administrator for Fisheries of the National Oceanic and Atmospheric Administration (NOAA) and became effective on January 1, 1982 (46 FR 63295, December 31, 1981). The FMP is implemented by Federal regulations appearing at 50 CFR 611.93 and Part 675. Eight of ten amendments to the FMP have been implemented. This document describes and assesses the potential effects of proposed changes that would constitute Amendment 11 to the FMP.

The Council solicits public recommendations for amending the FMP on an annual basis. Amendment proposals are then reviewed by the Council's Bering Sea Plan Team (PT), Advisory Panel (AP), and Scientific and Statistical Committee (SSC). These advisory groups make recommendations to the Council on which proposals merit consideration for the current year's amendment cycle. Amendment proposals and appropriate alternatives accepted by the Council are then analyzed by the PT for their efficacy and their potential biological and socioeconomic impacts. After reviewing this analysis, the AP and SSC make recommendations as to whether the amendment alternatives should be rejected or changed in any way, whether and how the analysis should be refined, and whether to release the analysis for general public review and comment. At its March 18-20, 1987 meeting, the Council received these recommendations and public testimony and decided to release the analysis of the amendment proposals and alternatives contained in this document. The Council will consider public comments on this analysis and any new information affecting the analysis at its May 20-22, 1987 meeting. The Council then will decide, based on this analysis, public comments, and the recommendations of the PT, AP and SSC, which amendment alternatives to recommend to the Secretary of Commerce for approval and implementation.

1.1 List of Amendment Proposals

Six amendment proposals are being considered by the Council to address specified fishery management problems in the groundfish fisheries in the Bering Sea and Aleutian Islands (BSAI) area. Amendment proposal alternatives approved by the Council will constitute Amendment 11 to the FMP. The following list of amendment proposals is not intended to reflect any priority.

(a) Establish DAP priority within 100 miles of Unalaska Island.
(b) Change the definition of prohibited species.
(c) Change catch recording requirements.
(d) Change the definition of acceptable biological catch.
(e) Change the specified range of optimum yield.
(f) Prohibit "roe-stripping" in the pollock fishery.

1.2 Purpose of the Public Hearing Package

The primary purpose of this document is to help the Council make informed decisions on whether and how to amend the FMP. By making this document available for public review, the Council also benefits from the resulting public comment on the analyses in this document. In addition, this document provides background information and assessments necessary for the Secretary of Commerce to determine that the FMP is consistent with the Magnuson Act and other applicable law. Other principal statutory requirements that this document is intended to satisfy are the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), and Executive Order 12291 (E.O. 12291).

1.2.1 Environmental Assessment (EA)

Part of the analysis in this document provides an EA that is required by NOAA to comply with NEPA. The purpose of the EA is to analyze the potential impacts on the quality of human environment of major Federal actions. The EA serves as a means of determining if significant environmental impacts could result from a proposed action. If the action is determined not to be significant, the EA will result in a finding of no significant impact (FONSI). This EA then would be the final environmental document required by NEPA. If a FONSI cannot be made, then a more detailed environmental impact statement (EIS) must be prepared. An EIS must be prepared if the proposed action may be reasonably expected: (1) to jeopardize the productive capability of the target resource species or any related stocks that may be affected by the action; (2)to allow substantial damage to the ocean and coastal habitats; (3) to have a substantial adverse impact on public health or safety; (4) to affect adversely an endangered or threatened species or a marine mammal population; or (5) to result in cumulative effects that could have a substantial adverse effect on the target resource species or any related stocks that may be affected by the action. Following the end of the public hearing, the Council could determine that Amendment 11 will have significant impacts on the human environment, and proceed directly with preparation of an EIS.

Certain management alternatives assessed in this document may have some impact on the environment. Such measures are those affecting harvests of stocks and may occur either directly from the actual removals of fish from the ecosystem or indirectly as a result of harvest operations (e.g. effects of bottom trawling on the animals and plants living on, or in, the sea bottom). Environmental impacts of management measures may be beneficial when they accomplish their intended effects (e.g. prevention of overharvesting stocks as a result of harvest quota management). Conversely, of course, such impacts may be harmful when management measures do not accomplish their intended effects (eg. overharvesting occurs when quotas are incorrectly specified. The extent of environmental harm depends on the amount of overfishing that has occurred. For purposes of this EA, "overfishing" is used as defined in the "Guidelines to Fishery Management Plans" (48 FR 7402, February 18, 1983) as "a level of fishing mortality that jeopardizes the capacity of a stock(s) to recover to a level at which it can produce maximum biological yield or economic value on a long-term basis under prevailing biological and environmental conditions."

Other environmental impacts that may occur as a result of fishery management practices include changes in predator-prey relations among invertebrates and vertebrates (including marine mammals and birds), physical changes to the sea bottom as a direct result of fishing practices, and nutrient changes due to processing and dumping of fish wastes. Given the natural variability in the environment and current capability to measure it, however, changes in the ecosystem due to changes in management measures that affect groundfish removals are expected to be difficult to detect.

1.2.2 Regulatory Impact Review (RIR)

Another part of this document is the RIR that is required by NOAA for all regulatory actions or for significant policy changes that are of public interest. The RIR: (1) provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems; and (3) ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether any proposed regulations are major under criteria provided by E.O. 12291 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with RFA. The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively, "small entities") of burdensome regulatory and recordkeeping requirements. This Act requires that if regulatory and recordkeeping requirements are not burdensome, then the head of an agency must certify that the requirement, if promulgated, will not have a significant effect on a substantial number of small entities.

The analysis in this document estimates the impacts that regulations implementing the described amendment alternatives would have on the groundfish fisheries in the BSAI area. It also provides a description of and an estimate of the number of vessels (small entities) to which these regulations would apply.

1.3 Description of the 1987 Domestic Fishing Fleet Operating in the Gulf of Alaska and in the Bering Sea/Aleutians Islands Area.

A total of 1,296 vessels may fish groundfish in the Bering Sea and Gulf of Alaska in 1987 (Table 1.1). This number is based on 1987 Federal groundfish permits that have been issued to domestic vessels as of March 27, 1987. This number includes vessels that will engage in only in harvesting operations (catcher vessels), vessels that will both harvest and process their catches (catcher/processor vessels), vessels that will only process fish (motherhip/processor vessels), and support vessels that will engage in transporting fishermen, fuel, groceries, and other supplies.

Table 1.1 Numbers of groundfish vessels that are less than 5 net tons or 5 net tons and larger that are federally permitted in 1987 to fish off Alaska.

	Number of Occurrences			
	Less than 5 net tons		Over 5 net tons	
HARVESTING ONLY	97		972	
HARVESTING/PROCESSING	19		188	
PROCESSING ONLY			2	
SUPPORT ONLY	___		18	
Total vessels	116	+	1,180	= 1,296

Of the total 1,296 vessels, 91 percent or 1,180 are 5 net tons or larger. Nine percent or 116 vessels are less than 5 net tons. The rest of this analysis is limited to discussion of the larger vessels, i.e., those that are 5 net tons or larger. These vessels are located in Seattle, Sitka, Kodiak, and Dutch Harbor, and other non-Alaska and Alaska ports. Most of these larger vessels come from Alaska, based on telephone area codes given with permit applications. The numbers of vessels that come from Alaska is 717; the number from the Seattle area is 280; and the number from other areas is 183. Vessels by processing mode are shown in Table 1.2.

Table 1.2 Numbers of groundfish vessels Federally permitted to fish off Alaska in 1987 from the Seattle area, Alaska, and other areas.

	Number		
Mode	Seattle Area	Alaska	Other Areas
HARVESTING ONLY	200	608	164
HARVESTING/PROCESSING	63	107	18
PROCESSING ONLY	2		
SUPPORT ONLY	15	2	___
Total	280	717	183

The total number of catcher vessels (harvesting only) and catcher/processor vessels (harvesting/processing) is 972 and 188, respectively. Net tonnages of catcher vessels and catcher/processor vessels varies widely. The total net tonnage of the catcher vessels is 56,047 net tons, and the total net tonnage of the catcher/processor vessels is 14,744 net tons.

Vessels involved in harvesting only (catcher vessels) employ mostly three types of gear: hook-and-line (longline), trawls, or pots. Most of the catcher vessels are hook-and-line vessels, which number 755 (see Table 1.3). They are mostly the smallest vessels fishing groundfish, having average net tonnage capacities equal to 28 net tons and average lengths of 47 feet.

Table 1.3 Numbers and statistics of catcher vessels by gear type that are Federally permitted to fish off Alaska.

	Number	Average Net Tons	Average Length (ft)
HOOK-AND-LINE	755	28	47
POTS	8	111	83
TRAWL	123	121	96
OTHER GEAR 1/	86	46	54
TOTAL	972		

1/ Other gear includes combinations of hook-and-line, pots, trawls, jigs, troll gear, and gillnets.

Vessels involved in harvesting and processing (catcher/processor vessels) also employ mostly hook-and-line, trawls, or pots. Most of the catcher/processor vessels, 118, also use hook-and-line gear (see Table 1.4). They are the smallest of the catcher/processor vessels, having average net tonnage capacities equal to 41 net tons and average lengths of 52 feet, but are larger than the catcher vessels using hook-and-line gear.

Table 1.4 Numbers and statistics of catcher/processor vessels by gear type that are federally permitted to fish off Alaska.

	Number	Average Net Tons	Average Length (ft)
HOOK-AND-LINE	118	41	52
POTS	5	127	104
TRAWL	27	246	144
OTHER GEAR 1/	38	67	63
TOTAL	188		

1/ Other gear includes combinations of hook-and-line, pots, trawls, jigs, troll gear, and gillnets.

For catcher/processors, pot vessels number 5 and trawl vessels number 27. Their respective average net tonnage capacities are 127 and 246 net tons. Their respective average lengths are 104 and 144 feet. Other combinations of catcher/processor vessels exist. Thirty-eight catcher/processor vessels are equipped with combinations of other gear.

2.0 ESTABLISH DAP PRIORITY WITHIN 100 MILES OF UNALASKA ISLAND

2.1 Description of and Need for the Action

The Magnuson Fishery Conservation and Management Act (MFCMA) outlines a priority to be used in determining fishery allocations within the Exclusive Economic Zone (EEZ). Domestic vessels that deliver to domestic processors (DAP) are afforded the highest priority. Domestic vessels that deliver to foreign processors (JVP) are considered next. Any amount surplus to these needs may then be allocated to foreign fishing vessels (TALFF). This preference has been interpreted as relevant to the preseason allocation of TAC. There also exists priority access for DAP during the fishing year in the sense that if the DAP amount is exceeded DAP then may fish into the TALFF and JVP allocations. A different interpretation of priority access is that the preference could extend to space and time, that DAP should be given priority on the grounds through area closures to JVP and TALFF or that DAP should be given priority in time through seasonal closures to JVP and TALFF.

In the spirit of the second interpretation of priority, the mayors of Unalaska and Akutan have proposed a regulatory change to allow only DAP fishing in an area within 100 miles of Unalaska. An objective of the proposal is to correct an access problem whereby local shoreside processing facilities in the communities of Unalaska/Dutch Harbor and Akutan have had difficulties securing a steady supply of groundfish. It is the presumption, therefore, that such priority access would help to correct the shoreside supply problem.

The analysis will discuss the effectiveness and efficiency of each proposed solution (alternative) in solving this shoreside delivery problem. However, at the same time, the analysis will attempt to address the larger question of how each alternative might affect DAP development. This perspective is, in a sense, a view of the course of "Americanization" and a scenario for the transition from a fishery where most of the catch is taken by joint venture vessels to a fishery that is fully utilized by U.S. harvesters and processors. Prediction of the likely time path of such a transition is extraordinarily difficult and the process is further complicated by the fact that Americanization will occur even if none of the alternatives to the status quo are implemented. Accordingly, it will only be possible to give a fairly qualitative assessment of how each alternative might alter the path of Americanization from the status quo. The efficacy of the status quo and the alternatives in enhancing shoreside delivery of product is discussed with more certainty. In either case, the analysis of the alternatives will focus on the likely impacts for the harvesting, processing, and retail sectors given adoption of one of the alternatives in contrast to what would happen if the status quo is maintained.

The following discussion examines the status quo (Alternative 1) and what might occur if DAP priority access were implemented through five proposed alternatives:

Alternative 2: Year-round DAP fishing only in Zone A (approximating 100-mile radius around Unalaska).
Alternative 3: Year-round DAP and joint venture fishing (but no foreign processing) within Zone A.
Alternative 4: Six-month closure of Zone A to foreign fishing and processing.
Alternative 5: Impose fees on foreign processors for joint venture caught fish.
Alternative 6: Seasonal apportionment of joint venture pollock quota.

2.2 The Alternatives

2.2.1 Alternative 1: Do nothing (the status quo).

Under the status quo any licensed or permitted vessel may target on any allocated groundfish species in any area of the Bering Sea/Aleutian Islands management area or Gulf of Alaska management area (Figure 2.1) as long as the TAC has not been taken. Exceptions to this are certain time/area restrictions. For the foreign fleet, the major restrictions are (Figure 2.2):

(a) Bering Sea/Aleutians. Year-round closure in the Pot Sanctuary area and seasonal closures in the Halibut Winter Savings Area.

(b) Western Gulf of Alaska. Year-round closure of Davidson Bank.

For the domestic fleet (JVP and DAP) the restrictions are (Figure 2.3):

(a) Bering Sea/Aleutians. Year-round closure of the area south of 58°N latitude, between 160°W and 162°W longitude, with an exception for DAH cod trawlers landward of a line approximating the 25-fathom contour.

(b) Closure of Zone 1 and Zone 2 to DAH flatfish trawling (yellowfin sole and other flatfish) when specified PSC limits for king crab, Tanner crab, or halibut are exceeded.

There are no current seasonal or area restrictions based upon priority access to DAP, JVP, or TALFF.

2.2.2 Alternative 2: Establish a year-round area closure not to exceed Zone A wherein only DAP operations are allowed.

Zone A has its corner coordinates at 52°30'N, 164°W; 55°N, 164°W; 55°N, 169°W; 52°30'N, 169°W (Figure 2.4).1/ This alternative would allow only fishing for domestic processors (shorebased or at-sea) in an area approximating a circle extending 100 miles from Unalaska. Joint venture and foreign operations are prohibited within the zone. The restrictions would be in effect for the

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1/ At this latitude each square is approximately 30 miles on a side. It follows that the closed area (Zone A) is a square approximately 150 miles on a side.

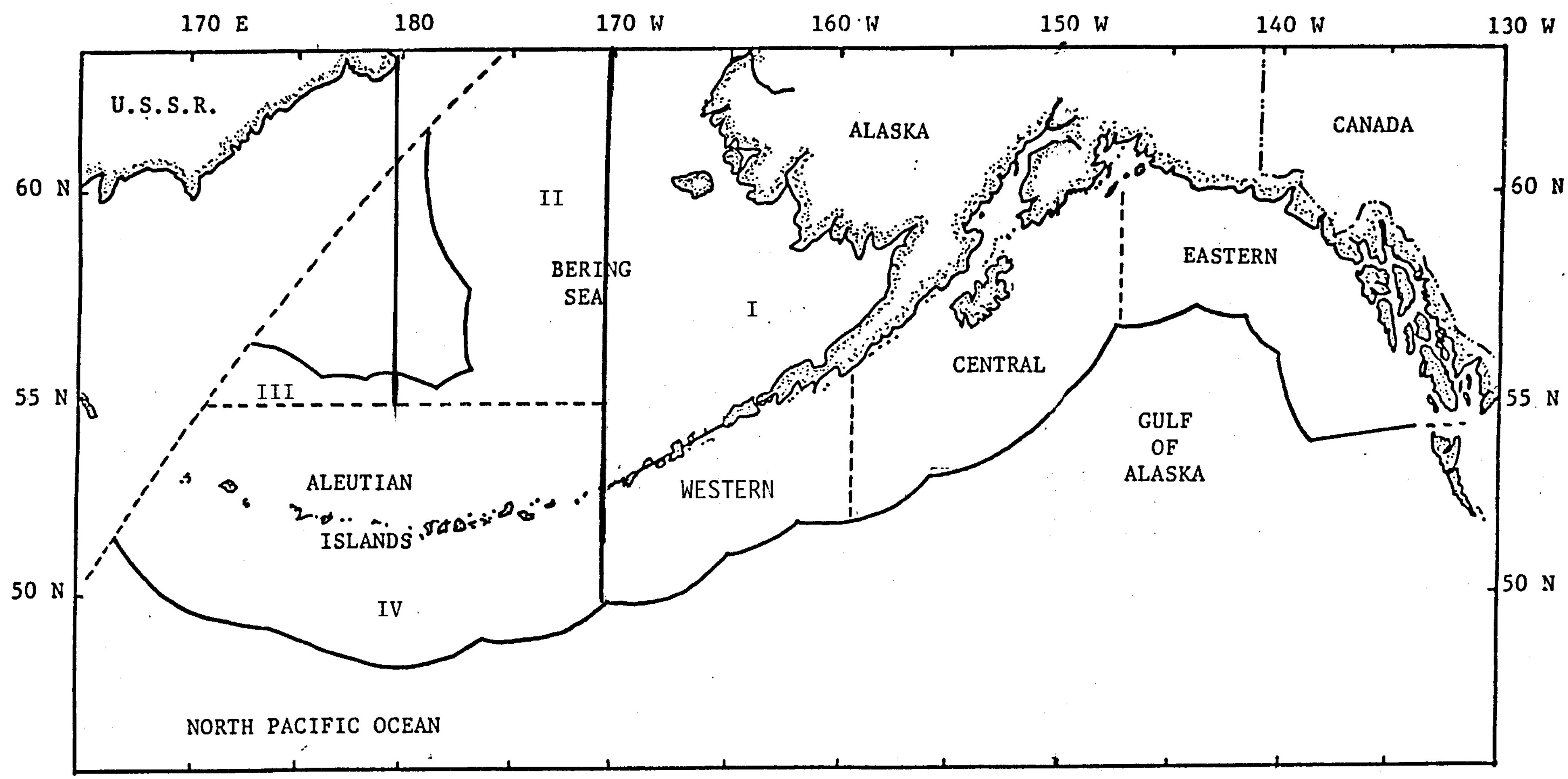

Figure 2.1 Major regulatory areas of the Bering Sea and Aleutian Islands Groundfish and Gulf of Alaska Groundfish FMP's.

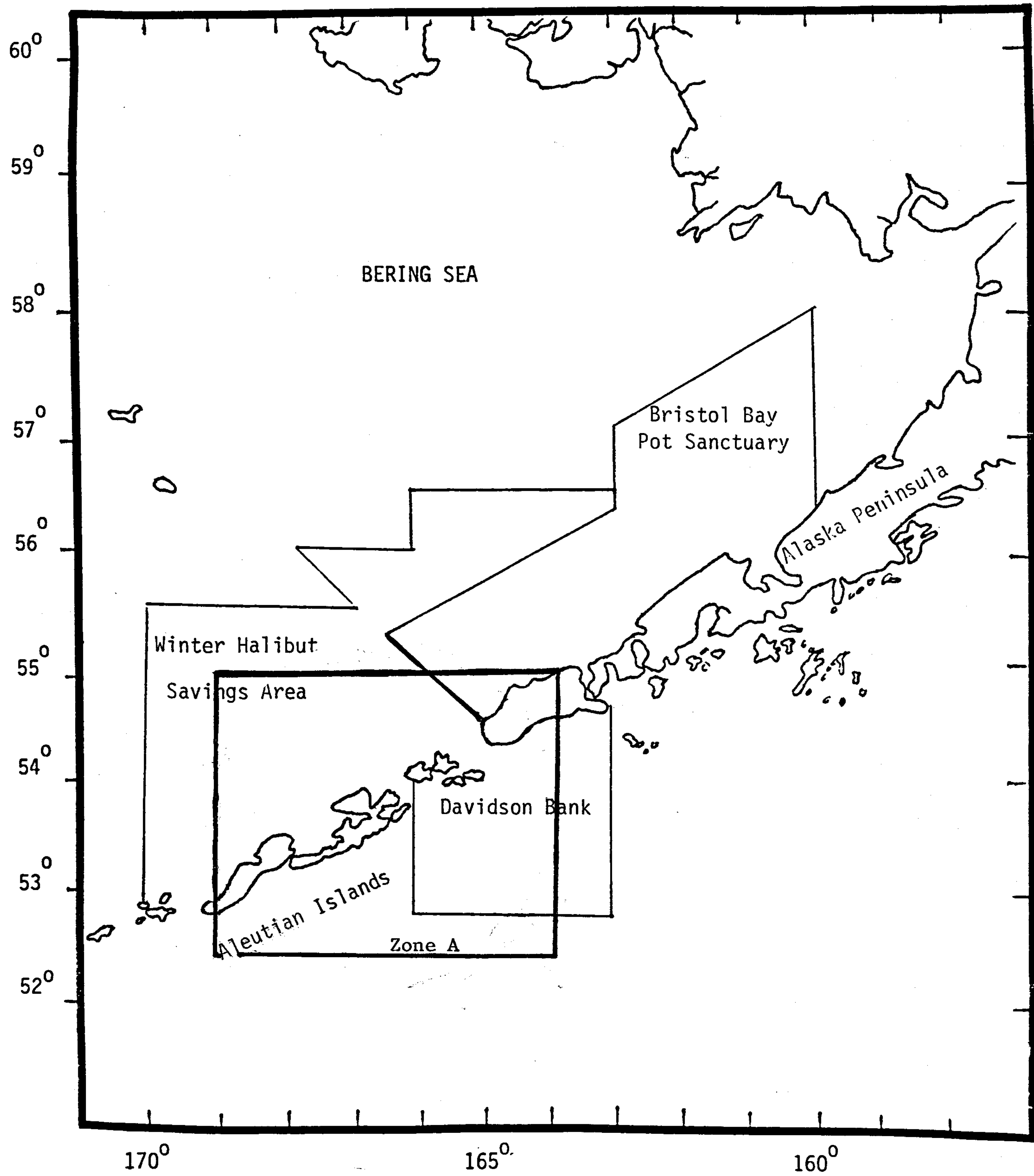

Figure 2.2 Alaska Peninsula/Aleutian Islands: Foreign closures currently in effect (Bristol Bay Pot Sanctuary, Winter Halibut Savings Area, and Davidson Bank) and proposed closed zone (Zone A).

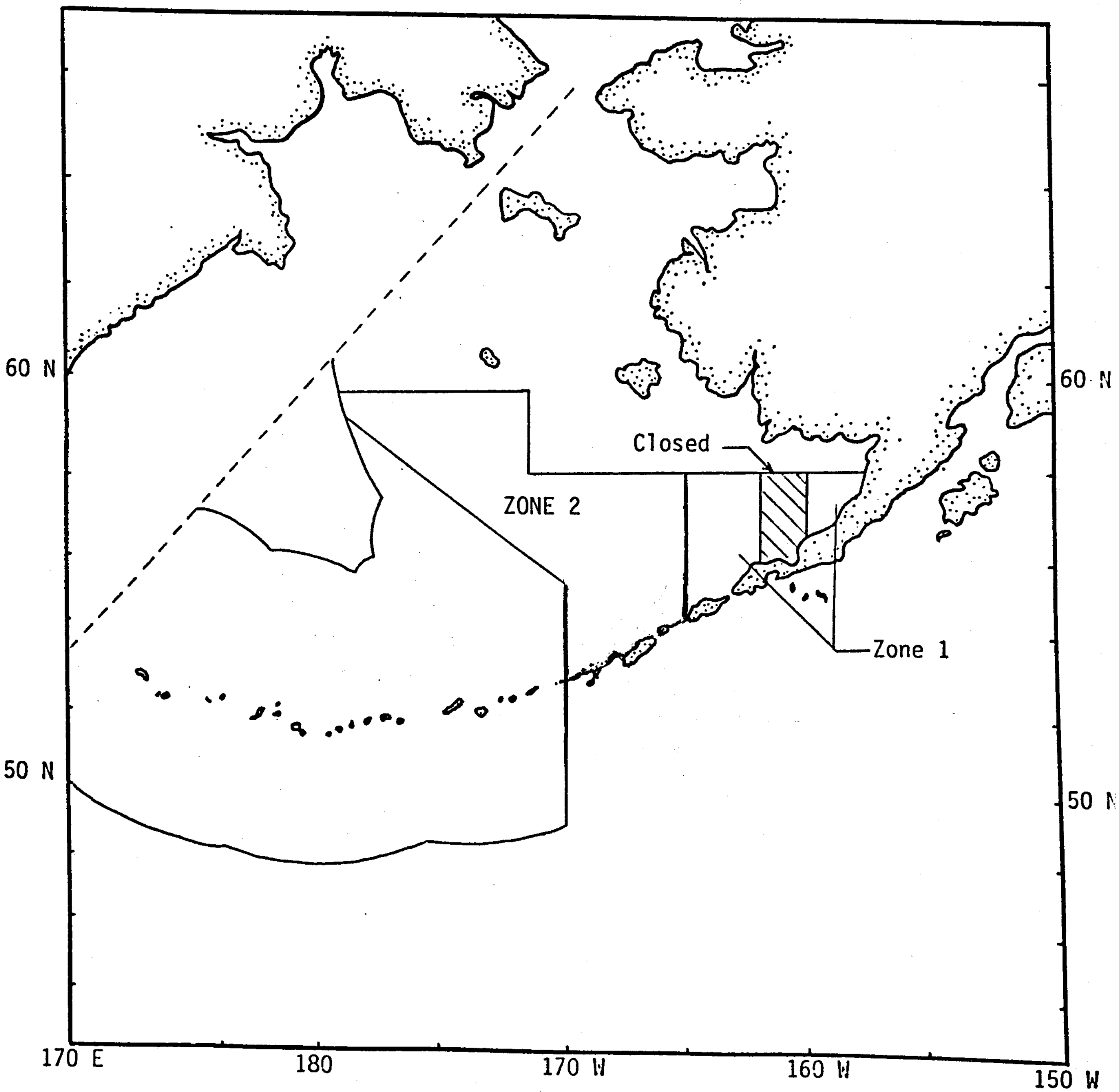

Figure 2.3 Areas (Zones) closed to fishing and DAH flatfish fishing under Amendment 10.

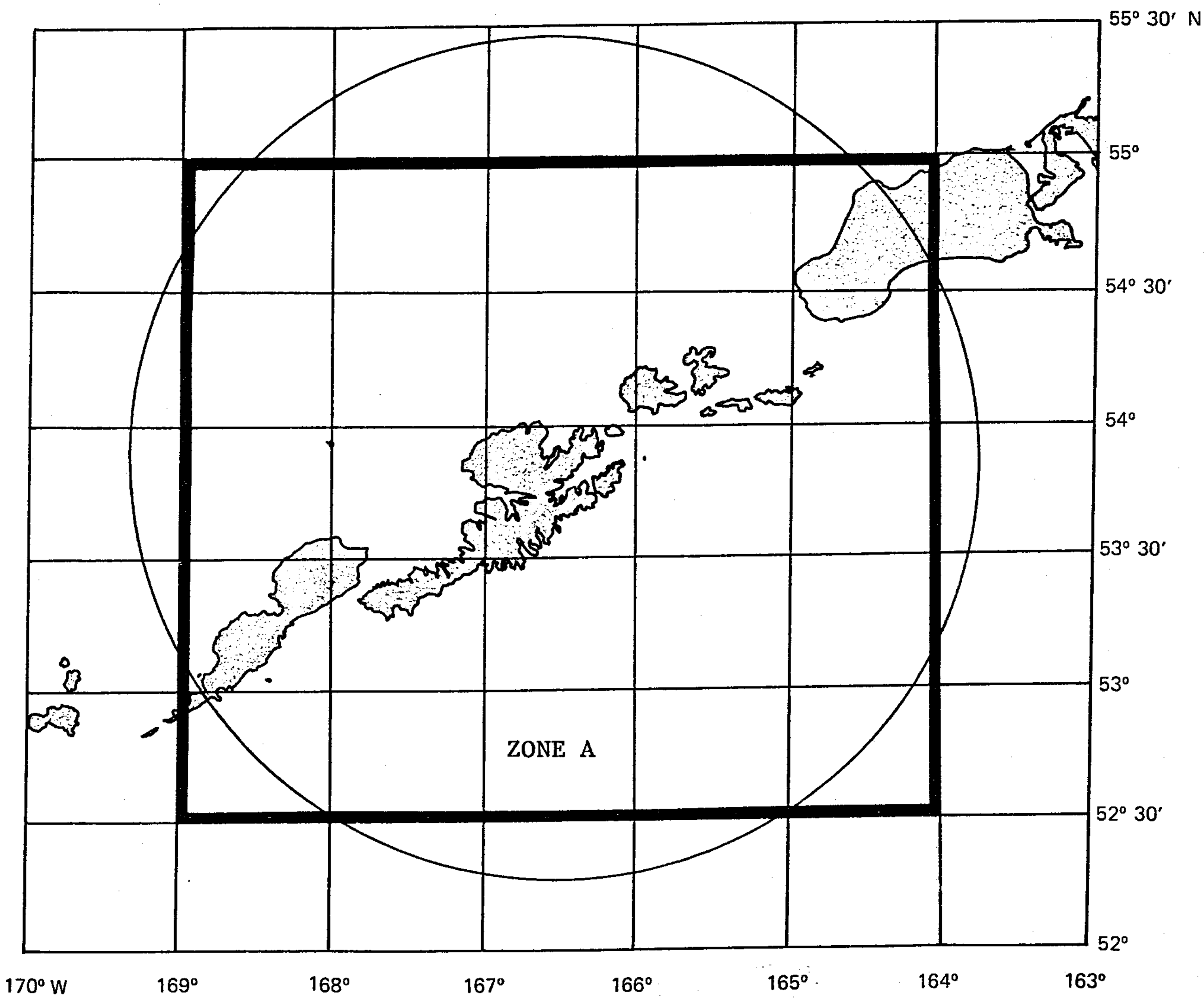

Figure 2.4 Zone A (bold line) in relation to the Aleutian Islands and a circle extending 100 miles from Unalaska.

entire fishing year. Since the zone includes areas in both the Gulf of Alaska and the Bering Sea/Aleutian Islands, both affected FMPs would need to be amended.

Data availability, and practicality in monitoring the catch, necessitate a departure from the original proposal by modifying the shape of the closed area from a 100-mile radius zone around Dutch harbor into Zone A which approximates the area as a square of 1/2° by 1° statistical blocks. This is required because it is difficult to estimate historical catch for areas that are not defined by combinations of 1/2° by 1° squares, and it is difficult to enforce regulations for areas that are not so defined.

2.2.3 Alternative 3: Establish a year-round area closure not to exceed Zone A wherein DAH fishing would be allowed only for those vessels delivering to DAP and those delivering to foreign processors outside Area A.

Zone A is the same as in Alternative 2 and defined in Figure 2.4. This alternative differs from Alternative 2 in that U.S. joint venture vessels are allowed to fish in the zone for delivery to foreign processing vessels outside of the zone. This difference to Alternative 2 is suggested since a regulation which would allow only DAP fishing would be difficult to enforce. A U.S. trawler could be acting as a DAP vessel on one tow in delivering the codend to a DAP at-sea processor or to a tender delivering shoreside, and on the very next tow as a joint venture trawler by delivering the codend to a foreign processor. Such a switch from DAP to JVP on two successive tows would render enforcement of the DAP-only fishing restriction in the zone nearly impossible.

2.2.4 Alternative 4: As in Alternative 3 except closure of Zone A is seasonal (January through June).

Zone A is the same as in Alternative 2 and defined in Figure 2.4. The alternative would prohibit foreign processing in Zone A from January 1 to June 30.

2.2.5 Alternative 5: Establish a fee structure for foreign processors who receive joint venture caught pollock.

This alternative proposes to "equalize" the cost differential for acquisition of DAP versus JVP pollock. It would establish a fee system similar to that in existence for the directed foreign fishery whereby foreign processors that receive pollock from domestic fishing vessels off the coast of Alaska would be required to pay a unit fee ($/mt) for the species received. The fee revenue would accrue to the U.S. Government.

2.2.6 Alternative 6: Establish a seasonal schedule for release of annual JVP apportionments for pollock in the Bering Sea/Aleutian Islands management area.

Seasonal apportionments to joint ventures are a way to permit some form of priority access to DAP operators while also allowing some joint venture operations.

This alternative would create a seasonal apportionment system for joint ventures within the BSAI area only. Seasons may be of any fixed period (e.g., quarterly, semi-annually) or the season interval may be variable or even frameworked. Various seasonal possibilities are presented based upon earlier and more recent historic catch distributions (Tables 2.1, 2.2, and 2.3). The analysis, however, focuses on two examples of semi-annual seasons. These semi-annual schedules (0/100% and 50/50%) were selected for simplicity and generality, but are based upon considerations for time-dependent DAP priority (0/100) and conformity with established trends in foreign and joint venture pollock fisheries (50/50). The specific scenarios considered should be viewed as possible examples of the alternative, not as limitations to Council action.[2/]

2.3 Biological and Physical Impacts

The likely impacts of doing nothing and of adopting each of the five alternatives to the status quo are examined in the following sections (2.3 and 2.4). There are two parts to the analysis--environmental impacts and socioeconomic impacts.

The issues are complex, the analysis of all aspects of each alternative requires a thorough presentation and discussion, and the amount of data presented in support of the analysis is large. Accordingly, the chapter is long. An overview of the benefits and costs of all alternatives and a comparison of alternative can be found in the final section, 2.4.6, "Cost-Benefit Conclusion".

2.3.1 Alternative 1: The status quo.

Although the status quo embodies no additional federal regulations, there are environmental impacts associated with inaction. Prosecution of the 1987 joint venture fishery for pollock in the Bering Sea has been greatly accelerated compared to recent years, capturing approximately 590,000 mt in the first quarter. This harvest amounts to over 70% of the 1987 joint venture apportionment (Tables 2.2 and 2.3). Such a concentration of targeting early in the year, particularly on spawning aggregations, could conceivably impact the reproductive potential of the stocks. Moreover, spring harvests preclude summer growth of those fish, thereby forfeiting some portion of the yield per recruit.

Unfortunately, there is no reliable spawner-recruit relationship with which to estimate possible risk to reproductive potential of the pollock stocks although there is reason to believe that the environment, rather than simply the number of available spawners, controls recruitment to the fishery. Under Alternative 6 a preliminary yield per recruit analysis is presented that suggests early harvests do forfeit summer growth and could eventually reduce

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2/ Alternative 6 is a late addition to the amendment package, recommended to the Council on March 19 by the Advisory Panel. The very limited time available within the established amendment package schedule has permitted analysis of this option as a basis of choice among alternatives presented, but has not allowed sufficient time for a complete and thorough analysis of all possible subalternatives, nor for initial public review and comment.

Table 2.1. Average monthly proportions of annual pollock harvests by Japan in the Bering Sea/ Aleutian Islands for 1968-1973 and 1971-1980 and translation to possible seasonal JVP apportionments.

Month	Percent Harvest by Month		Apportionments (%)			
			Based on 1968-73		Based on 1971-80	
	1968-73	1971-80	Semi-annual	Quarterly	Semi-annual	Quarterly
Jan	2.5	2.4				
Feb	2.4	3.1				
Mar	9.0	5.8		14		11
Apr	10.2	7.5				
May	10.5	7.8				
Jun	10.9	10.7	46	32	37	26
Jul	16.8	17.2				
Aug	16.8	17.7				
Sep	12.6	14.9		46		50
Oct	3.3	7.0				
Nov	2.3	3.8				
Dec	2.7	2.2	54	8	63	13
Total	100.0	100.0	100	100	100	100

Table 2.2. Proportional monthly JVP harvests of walleye pollock in the Bering Sea/ Aleutian Islands, 1983-1986. (ADFG, PacFIN) and translation to seasonal apportionments based on 1983-86 and 1986 harvest distributions.

Month	Percent Harvest by Month				Apportionments (%)			
					Based on 1983-86		Based on 1986	
	1983	1984	1985	1986	Semi-annual	Quarterly	Semi-annual	Quarterly
Jan	0.0	0.0	0.0	0.1				
Feb	0.0	0.2	0.5	5.4				
Mar	0.2	12.2	12.8	22.1		19		28
Apr	8.6	18.1	15.6	12.2				
May	8.0	0.7	1.7	2.3				
Jun	17.4	13.5	6.7	5.7	44	25	48	20
Jul	35.6	31.1	31.0	17.8				
Aug	24.2	18.7	18.7	17.2				
Sep	6.0	5.2	11.2	9.3		51		44
Oct	0.0	0.1	1.4	5.6				
Nov	0.0	0.0	0.5	1.5				
Dec	0.0	0.0	0.0	0.8	56	5	52	8
Total	100.0	100.0	100.0	100.0	100	100	100	100

Table 2.3. Preliminary harvest levels of JVP pollock in the Bering Sea, Jan - March, 1987 (Best Blend), projection of possible further harvests and translation to seasonal apportionment

Month	JVP pollock harvest (mt)	JVP pollock harvest (%)	Apportionment Semi-annual (%)	Apportionment Quarterly (%)
Jan	45725	5.5		
Feb	311254	37.5		
Mar 28	230848	27.8		71
Apr				
May				
Jun			100	29
Jul				
Aug				
Sep				0
Oct				
Nov				
Dec			0	0
Total	830013	100	100	100

Note: total JVP harvest to March 28 = 587,827 mt.

the stock biomass over a period of years. The status quo imposes no limits on what portion of the annual pollock harvest can be taken early in the year; therefore, the status quo may cause reduction of the stock due to early harvest. However, this risk is inherent in the open access nature of the fishery, not in any relative priority to domestic processors. In the long term, a similar risk could be posed by a highly capitalized DAP sector.

2.3.2 Alternative 2: Zone A closure to all but DAP.

Closure of an area up to Zone A (Figure 2.4) could lead to changes in the magnitude and distribution of the species biomass in the BSAI and GOA management areas if it results in significantly less overall harvest than under the status quo.

To analyze the potential biological and socioeconomic impacts of closing Zone A, recent fishery performance data were examined. The data used were 1984-85 catches, by species, by month, and by 1/2° by 1° square. These are the most recent available data, since 1986 catch data by 1/2° by 1° areas will not be available until later this year. The data are the best available, but it is important to point out two limitations of the current analysis:

(a) First, as is evident from 1984-86 and from what is being reported concerning the 1987 fishery, very rapid changes in the pattern of the fishery are taking place. The most obvious trends are a rapid decline in the amount of directed foreign harvest and the concomitant increase in joint venture harvest and a shift in the joint venture catch of pollock to the first quarter of the year. Also notable is a rapid increase in the amount of allocations to DAP. This means that the impacts considered, using data from 1984 and 1985, may misrepresent the present fishery to some unknown degree. In 1986 and 1987 joint venture fishing took more fish, took more pollock in the spring, and may have taken a larger proportion of the pollock catch in Zone A. Therefore, the "worst case" scenarios discussed below may understate the maximal impact that might occur.

(b) Second, the 1/2° by 1° square catch data are based on raw observer data. Since the observer coverage on fishing vessels is not 100%, it is necessary to extrapolate the data to predict actual catch in a square. These extrapolations are made at the INPFC area level (Bering Sea I, Bering Sea II, etc.); hence, the expanded square estimates assume a constant level of coverage within the INPFC area. To the extent that this assumption is invalid, and to the extent that catches differ in composition from square to square, the estimates presented herein will be in error. Our ability to accurately estimate catch by area for the joint venture fisheries is also limited by the fact that the position of the foreign processing vessel, and not of the haul, is used.

Keeping these caveats in mind, the 1984 and 1985 joint venture and foreign fishery performance data are presented in Table 2.4. The Shumagin INPFC area (which is the same as the western Gulf subarea in the Gulf of Alaska) is also included, as Zone A extends southward of Unimak Pass. Aggregating the catches for Zone A versus the remainder of the Bering Sea and western Gulf areas allows comparison of the relative contribution of Zone A to total catch (Table 2.5).

Table 2.4 1984 and 1985 joint venture and foreign catches in the BSAI Management Area and Shumagin Submanagement Area, by INPFC area, in metric tons.

INPFC Area		Pollock	P. Cod	Atka Mackerel	Flatfish	Rockfish	All Species
				Joint Venture			
BS I	1984	185,863	24,136	1	49,741	156	261,128
	1985	359,324	35,551	3	172,403	35	574,785
BS II	1984	44,450	245	15	64	0	44,809
	1985	10,933	83	0	18	0	11,062
BS IV	1984	6,694	6,390	35,927	365	465	51,606
	1985	7,283	5,638	37,856	325	428	53,574
Shumagin	1984	8,018	305	578	566	1,658	11,471
	1985	12,246	310	1,842	324	239	15,247
				Foreign			
BS I	1984	256,870	20,163	23	152,894	169	435,773
	1985	245,141	14,071	1	127,598	50	391,292
BS II	1984	604,871	37,070	18	29,828	293	679,256
	1985	524,278	42,267	1	20,000	65	591,829
BS III	1984	348	--	--	--	--	348
BS IV	1984	70,900	1,277	71	3,386	456	77,334
	1985	50,864	839	0	48	4	51,871
Shumagin	1984	42,471	10,843	478	603	311	55,798
	1985	23,821	7,338	2	11	115	31,382

Sources:

Berger, J., R. Nelson Jr., J. Wall. 1985. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1984, NWAFC.

Berger, J., S. Murai, R. Nelson Jr., J. Wall. 1986. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1985, NWAFC.

Table 2.5. 1984 and 1985 Joint Venture and Foreign Catches Inside and Outside the Proposed 100-mile Closure by Area. (mt) /1,2/

Area	Pollock	P. Cod	A. Mackerel	Flatfish	Rockfish	All Groundfish
(Joint Ventures)						
1984						
Closure - BSAI	42,897	10,722	0	1,467	151	56,195
- W. GOA	7,816	215	510	458	1,291	10,509
Subtotal	50,713	10,937	510	1,925	1,442	66,704
Outside - BSAI	194,111	19,999	35,943	48,703	471	301,348
- W. GOA	202	91	68	109	368	961
Subtotal	194,313	20,090	36,011	48,812	839	302,309
1985						
Closure - BSAI	56,414	11,561	1	1,672	29	71,561
- W. GOA	11,384	288	1,842	264	239	14,409
Subtotal	67,798	11,849	1,843	1,936	268	85,970
Outside - BSAI	321,126	29,711	37,858	171,074	434	567,861
- W. GOA	862	22	0	61	0	839
Subtotal	321,988	29,733	37,858	171,135	434	568,700
(Foreign)						
1984						
Closure - BSAI	97,365	2,126	219	7,738	45	108,653
- W. GOA	22,212	810	6	191	124	24,656
Subtotal	119,577	2,936	225	7,929	169	133,309
Outside - BSAI	835,624	56,384	0	178,370	873	1,083,710
- W. GOA	20,259	10,033	472	412	187	31,142
Subtotal	855,883	66,417	472	178,782	1,060	1,114,852
1985						
Closure - BSAI	109,936	897	0	3,468	11	115,196
- W. GOA	8,198	89	2	26	0	8,335
Subtotal	118,134	986	2	3,494	11	123,531
Outside - BSAI	710,347	56,280	2	144,178	108	919,796
- W. GOA	15,623	7,249	0	0	115	23,047
Subtotal	725,970	63,529	2	144,178	223	942,843

/1/. The "closure" is the block shown in Figure 2.4. "Outside" is the area not included in the 100-mile square.
/2/. Source: Foreign observer database, NWAFC. Data used are catches by 1/2° x 1° square expanded to account for % observer coverage and aggregated over the relevant area.

To facilitate data comparisons, the percentages of the catch by management area (BSAI - all areas; GOA - W. Gulf) are shown in Table 2.6 and Figure 2.5. Some general conclusions can be drawn from these data:

(a) The Gulf of Alaska portion of Zone A produced a significant portion of the joint venture catch in the western Gulf in 1984 and 1985. Catches of all groundfish combined in Zone A ranged from 91.6% (1984) to 94.5% (1985) of the total western Gulf catch.

(b) The percentage contribution (26.6% in 1985; 44.2% in 1984) of the foreign catch in the western Gulf portion of Zone A is much less than the joint venture catch in the same zone.

(c) The Gulf part of the closed area is much less significant in terms of contribution to total catch (mt) than the Bering Sea portion of the zone.

(d) In the BSAI management area, the proposed closure is relatively more important to the joint venture fleet than to the foreign fleet. Overall, the proportion of total catch that occurred in the Bering Sea portion of the zone is between 11.2% and 15.7% for the joint venture fleet and between 9.1% and 11.1% for the foreign fleet.

(e) The proportion of each species caught in the BSAI portion of Zone A varies from year to year. Percentage of catch at the species level ranges from zero for Atka mackerel (joint ventures - 1984 and 1985; foreign - 1985) to as much as 18.1% for pollock (joint venture - 1984) and 34.9% for cod (joint venture - 1984).

What is important for this analysis, however, is not what the catch was in 1984 or 1985 but what the distribution and total amount of harvest would be if Zone A were in fact closed to joint venture and foreign fishing. This is difficult to assess since current and expected future fisheries are much different than what occurred two or three years ago. Second, it is difficult to predict how the fishing pattern would be re-adjusted to make up for the foregone catch in Zone A. The "worst case" scenario assumes that the catch foregone would not be made up in the remaining open area. The opposite "best case" scenario assumes that all catch foregone could be harvested elsewhere.

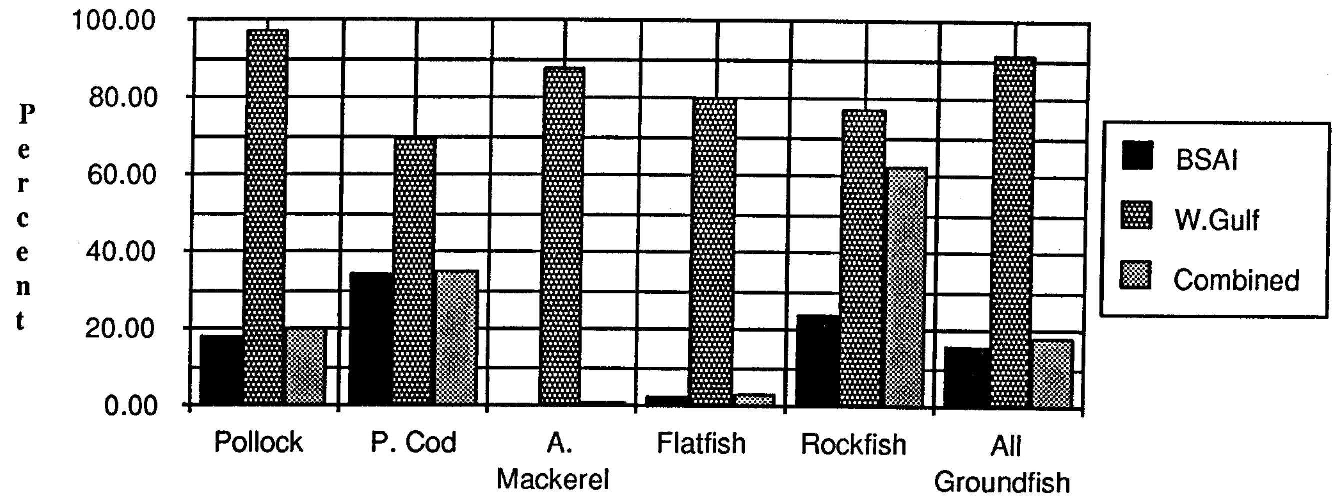
Evidence of the ability to make up the potential catch foregone from closure of Zone A is given by recent fishery and survey performance. Figures are collected in three appendices. Appendix A contains figures showing the distribution of foreign catch of cod and pollock in 1982 through 1985. Since foreign fishing is not allowed in much of the proposed closure, these annual catch distributions are useful only with regard to the location and catchability of fish in the remainder of the BSAI. Appendix B presents charts of effort (hauls--all species) by foreign and joint venture fisheries, by month, for the years 1984 and 1985. This set of figures indicates substantial fishing effort outside Zone A at certain times of the year. Appendix C is a set of charts of summer population survey results. CPUE for cod for 1985 and 1986 and pollock for the years 1982 through 1986 indicate that, during the period of the summer survey, the populations of these two species are dispersed throughout the BSAI.

Table 2.6. Percentage of 1984 and 1985 Joint Venture and Foreign Catches Occurring in Proposed Closed Area, by Area and Species. /1/

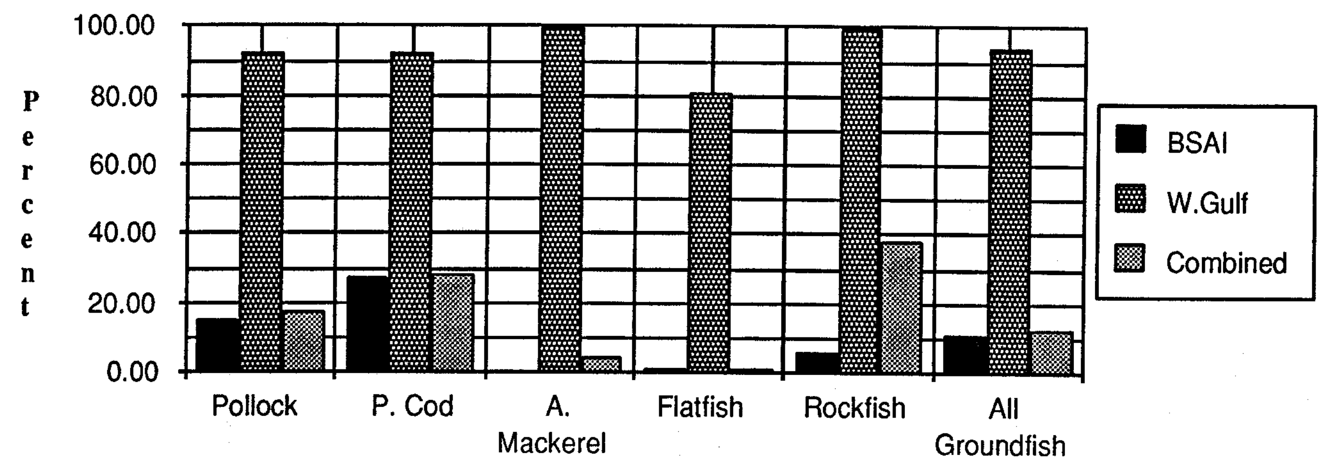
Block/Area	Pollock	P. Cod	A. Mackerel	Flatfish	Rockfish	All Groundfish
(Joint Ventures)						
1984						
Closure - BSAI	18.1%	34.9%	0.0%	2.9%	24.3%	15.7%
- W. GOA	97.5%	70.3%	88.2%	80.8%	77.8%	91.6%
Subtotal	20.7%	35.2%	1.4%	3.8%	63.2%	18.1%
1985						
Closure - BSAI	14.9%	28.0%	0.0%	1.0%	6.3%	11.2%
- W. GOA	93.0%	92.9%	100.0%	81.2%	100.0%	94.5%
Subtotal	17.4%	28.5%	4.6%	1.1%	38.2%	13.1%
(Foreign)						
1984						
Closure - BSAI	10.4%	3.6%	100.0%	4.2%	4.9%	9.1%
- W. GOA	52.3%	7.5%	1.3%	31.7%	39.9%	44.2%
Subtotal	12.3%	4.2%	32.3%	4.2%	13.8%	10.7%
1985						
Closure - BSAI	13.4%	1.6%	0.0%	2.3%	9.4%	11.1%
- W. GOA	34.4%	1.2%	90.0%	100.0%	0.1%	26.6%
Subtotal	14.0%	1.5%	45.0%	2.4%	4.8%	11.6%

/1/. This is the amount of catch foregone if only DAP fishing is allowed and none of the catch is made up outside the closed area.

Figure 2.5. Percent of Joint Venture Catch Inside Closure

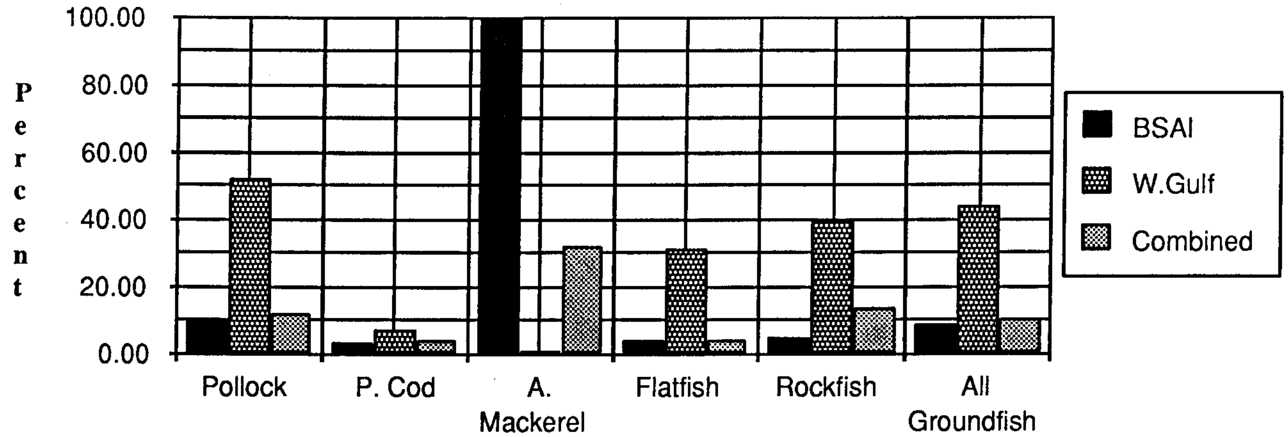


1984

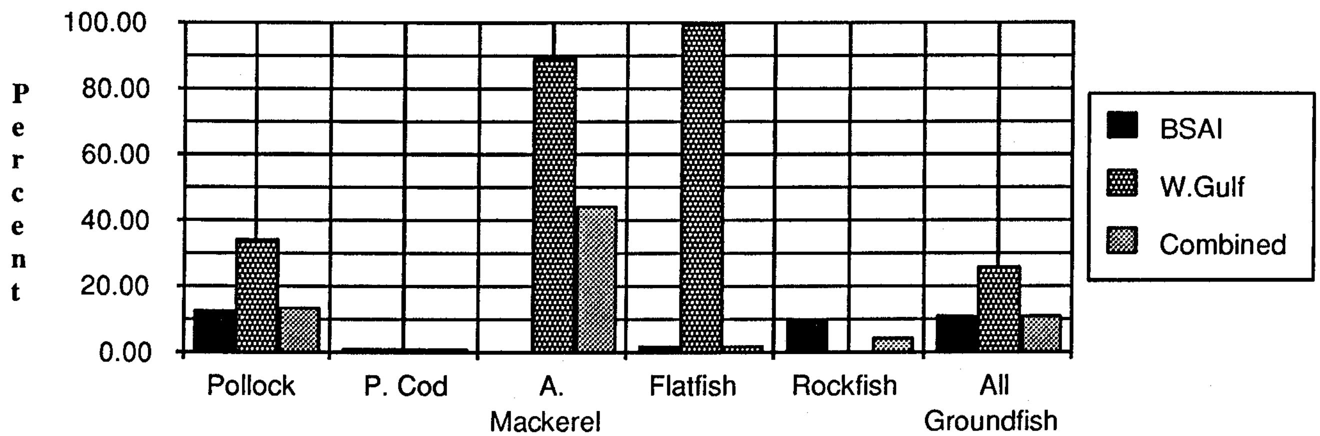


1985

Figure 2.5 (cont.). Percent of Foreign Catch Inside Closure



1984



1985

A possible conclusion from this information is that at certain times of the year, and on an overall annual basis, considerable catch and effort takes place outside Zone A. Nevertheless, Zone A remains one of the most productive areas for cod and pollock, especially in the early and late portions of the fishing year.

Regardless of the fleet's potential to make up the catch foregone by closure of Zone A, there may be associated biological impacts under Alternative 2 since the spatial distribution of the harvest will change. This would impact (a) the biological status of the resources, (b) the bycatch pattern of prohibited and other groundfish species, and (c) the interactions with marine mammals and birds. Some of the impacts are:

Impact on the Fishery Resources

Pollock. The biomass, age structure, and spawning biomass for pollock are showin in Table 2.7. Since Zone A is an area where spawning pollock are found, its closure would reduce the very intensive fishery on this spawning aggregation by joint venture fisheries. This will allow more pollock to spawn before capture later in the year. However, it cannot be determined if the intensive fishery in a small area within Zone A in a three-month period (January-March) is detrimental to the stock. Conversely, it is not known if any extra spawning that might be due to closure of Zone A would result in subsequent stronger year classes since a clear spawner-recruit relationship has not been demonstrated.

Pacific cod. This species is highly migratory in and out of Zone A within the year. Since the status quo cod fishery in Zone A is not designed to target on roe-cod, the catching of cod inside or outside Zone A would probably not have significantly different impacts on the long-term status of the stock.

Atka mackerel. This species has been harvested almost exclusively by joint venture vessels. The recent (1983-85) catch pattern suggests that much of the fish harvested outside Zone A would take place to the west where the fish concentrate earlier in the year (instead of in Zone A around June). Fish outside Zone A are also known to be of a smaller size (10-12 inches, age 3) than those taken in Zone A late in the year (14 inches). A yield-per-recruit analysis, however, has shown that harvesting the smaller sized fish produces the maximum yield-per-recruit. Therefore, it is doubtful that the catching of Atka mackerel inside or outside Zone A would have a significantly different impact on long-term yield from the resource.

Impact on Bycatch

If Alternative 2 is chosen (closure of Zone A), the joint venture fleets would likely attempt to make up the catch foregone from Zone A outside the zone. Any fishing pattern adjustment by the foreign fleets would be minimal. To harvest the foregone pollock and cod, joint venture fisheries would have to move north, northeast, or northwest of Zone A.

In the northerly and northwest movement to seek pollock and cod, the incidental catch of prohibited species would not be a serious problem. More *C. opilio* tanner crabs may be taken, but this is not anticipated to be serious

Table 2.7 Estimated biomass of Bering Sea pollock based on cohort analysis. The spawning biomass is estimated from the age structure based on maturity ratios by age groups.

Stock Biomass (in 1000 mt) by age groups by year

AGE	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	1047	952	1379	2641	945	1216	311	1278	--
3	1734	1381	1306	1910	3801	1426	1848	455	1934
4	1694	1672	1280	1141	1939	4081	1645	2165	504
5	1378	1321	1252	979	959	1662	3463	1475	1996
6	597	1021	907	764	706	733	1199	2441	1022
7	674	492	864	666	590	591	624	947	1853
8	576	533	387	674	494	453	473	491	694
8	565	415	404	285	487	356	336	360	356

Percent maturity by age groups

AGE	2	3	4	5	6	7	8	9	10	11
%	.8	28.9	64.1	84.2	90.1	94.7	96.3	97.0	97.8	98.4

Spawning Biomass (in 1000 mt) by year

YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985
BIOMASS	5035	4892	4663	4374	5299	6439	6959	6690	6252

given historical experience by the foreign fisheries. If, however, reduced CPUE in other areas leads to an increase in the amount of fishing time to catch the same amount of fish, bycatch may increase.

Northeast movement into shallower waters would likely increase the incidental catch of prohibited species (crabs and halibut). The amount of the increase cannot be accurately predicted. Regulations are already in place to limit the incidental take of these species in the foreign and joint venture fleets that target on flatfish in "bycatch sensitive" areas of the Bering Sea (see Figure 2.3 for bycatch zones), but other fisheries are not so limited.

Compared to the status quo fisheries, any impact to the incidental catch of other groundfish species appears not to be a problem. The catch quotas for these species are controlled annually by regulation.

Interactions with Marine Mammals and Birds

Since the joint venture fisheries could be moved from areas of high catch levels within Zone A to other areas, the total amount of fishing time to catch the same amount of fish could be increased. If the amount of detrimental encounters with marine mammals and birds is directly related to increased fishing time, then there could be more adverse impact on these animals under Alternative 2 than under the status quo. However, such an increase is likely comparable to effort expanded in the recent past which caused no identifiably serious problems for marine birds and mammals.

While most species of marine mammals in the Bering Sea/Aleutians and the Gulf of Alaska are known to be at optimal sustainable population (OSP), three species (northern fur seal, Steller sea lion, and harbor seal) appear to have declined in abundance from levels recorded in earlier periods. Northern fur seals and Steller sea lions have declined to about half their 1960s populations. In the eastern Aleutian Islands, the sea lion population has declined by 79% over the past 25 years.

Another aspect of impact on marine mammals and birds is competition for the fish (which serves as food for these animals) with fishermen. In the sense that the total catch of groundfish and its component species are limited annually within OY, there should be little difference in the overall impact relative to the status quo. The potential movement of some of the joint venture operations to the vicinity of Pribilof Islands, however, may increase competition with marine bird and fur seal populations. The Islands are important breeding areas for fur seals and seabirds and an abundant supply of pollock, especially juvenile pollock, in its vicinity is important to birds and seals. It is difficult to determine if the movement of some joint venture fisheries to the vicinity of the Pribilofs would be detrimental to the marine birds or fur seals. The fisheries target on adult pollock and should not be in direct competition with the seals or birds for food. In fact, commercial harvest of larger pollock would reduce their consumption of juvenile pollock (cannibalism) and perhaps allow for greater abundance of juvenile pollock for bird and mammal prey. On the other hand, it is not known if the fisheries would affect subsequent recruitment of juvenile pollock near the Pribilof Islands.

2.3.3 Alternative 3: Zone A closure to foreign processors.

Alternative 3 differs from the previous alternative in that joint venture vessels may catch fish inside Zone A and then deliver to a foreign processor waiting outside the zone boundary. The extent of this "outside" delivery is impossible to predict although one joint venture operation volunteered that they would be unwilling to tow the hauled-back net for more than an hour (6 nautical miles or approximately 7 miles at 6 knots). This means that if the productive schools are found within 7 miles of the square boundary little catch may be foregone. Obviously, the distribution of schools will vary from day to day and from year to year, making it impossible to predict the actual extent of delivery outside the zone.

As reasoned under Alternative 2, it is likely that most of the foregone catch within Zone A will be made up outside Zone A. Since some of the joint venture vessels may fish within Zone A for delivery outside it, it appears that any environmental impact associated with the adoption of Alternative 3 would be equal to or less than under Alternative 2. Since the environmental impact has already been discussed under Alternative 2, it will not be repeated here.

2.3.4 Alternative 4: Six-month closure of Zone A.

This alternative would close Zone A to foreign processing vessels during the first half of the year (January 1 to June 30). Since Alternative 4 is a subset of Alternative 3--closing the area for half rather than the entire year--the biological impact of this alternative is therefore less than that described for Alternative 3.

Catches by month for 1984 and 1985 for both joint venture and foreign vessels are shown in Table 2.8 and Table 2.9. Data for these years indicate that, in terms of total groundfish catches for joint venture and foreign harvesters, the summer months were most important. The same general relation holds at the individual species level. Note that for the pollock fishery, however, the winter-spring roe fishery (February, March, April) is an important component of the total fishery. Reports from the 1987 fishery indicate the importance of the roe season to the total fishery is increasing since more than 590,000 mt of pollock were taken by March 28 (Table 2.3), a large proportion apparently from Zone A.

The domestic cod fishery is also a seasonal fishery. In the spring-early summer period bottom trawlers target on concentrations of cod in the Unimak Pass area. Later in the year, however, the trawlers target flatfish, taking significant amounts of cod as bycatch. That is, later in the year these domestic trawlers are operating in a general mixed species on-bottom fishery with mixed catches of cod, pollock, and flounder. Fishermen's representatives have indicated the spring-early summer cod is a higher quality product than that taken later as bycatch. A seasonal closure of Zone A would be expected to have an especially adverse impact on the fishery that targets on cod.

The percentage of catch in the BSAI portion of the zone in the first six months of the year in 1984 and 1985 is shown in Table 2.10 The impacts in the Gulf of Alaska portion of the zone are not included as the fishery in that part of the western Gulf is predominantly a late summer-fall fishery (see Appendix B - effort distribution). Based upon experience in the 1987 fishery,

Table 2.8 1984 joint venture and foreign catches in the BSAI Management Area and Shumagin Submanagement Area, by month, in metric tons.

Month	Pollock	P. Cod	A. Mackerel	Flatfish	Rockfish	All Groundfish
			Joint Venture			
Jan	42	207	0	26	0	281
Feb	553	3,880	0	323	0	4,831
Mar	28,783	6,941	0	775	0	36,732
Apr	42,991	3,722	1,987	4,685	331	53,883
May	1,859	2,693	7,989	7,731	584	21,660
Jun	31,969	3,799	10,093	10,854	354	57,740
Jul	68,982	3,755	10,056	5,857	536	89,704
Aug	50,636	3,546	6,164	9,999	259	71,082
Sep	12,022	2,272	15	9,457	61	24,069
Oct	7,059	263	217	1,029	156	8,899
Nov	130	1	0	1	1	134
TOTAL	245,026	31,079	36,521	50,737	2,282	369,015
			Foreign			
Jan	13,140	2,334	2	1,078	4	16,804
Feb	74,462	8,787	1	1,676	15	85,261
Mar	10,548	2,339	1	5,144	2	18,423
Apr	4,871	3,013	0	10,699	7	19,096
May	24,754	1,067	1	6,232	27	32,507
Jun	82,224	5,631	35	12,649	116	102,215
Jul	129,399	3,101	177	17,964	96	151,726
Aug	175,598	5,851	6	31,459	485	215,284
Sep	158,808	4,730	26	21,831	109	187,510
Oct	122,722	8,862	39	31,488	136	166,071
Nov	101,553	11,374	284	25,292	177	140,957
Dec	77,383	12,264	18	21,199	50	112,656
TOTAL	975,462	69,353	590	186,711	1,224	1,248,510

Source: Berger, J., R. Nelson Jr., J. Wall. 1985. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1984, NWAFC.

Table 2.9 1985 joint venture and foreign catches in the BSAI Management Area and Shumagin Submanagement Area, by month, in metric tons.

Month	Pollock	P. Cod	A. Mackerel	Flatfish	Rockfish	All Groundfish
			Joint Venture			
Jan	121	136	0	8	0	268
Feb	1,902	4,141	0	519	0	6,635
Mar	45,154	6,837	0	1,150	1	53,376
Apr	61,912	3,236	4,094	10,737	45	80,815
May	7,588	3,056	17,766	36,330	134	66,107
Jun	22,151	5,602	8,899	29,592	222	66,683
Jul	130,267	7,298	7,602	33,141	36	179,838
Aug	60,228	5,374	0	31,270	4	99,630
Sep	41,608	4,006	1,175	19,799	123	68,620
Oct	15,873	1,800	657	10,478	134	29,539
Nov	2,982	98	8	46	4	3,155
TOTAL	389,786	41,584	39,701	173,070	703	654,666
			Foreign			
Jan	15,458	1,044	0	9,042	6	25,631
Feb	17,535	12,496	0	2,733	1	33,146
Mar	16,638	4,040	0	8,137	0	28,983
Apr	1,334	2,113	0	7,936	4	11,704
May	4,550	2,579	0	6,777	10	14,520
Jun	40,714	956	.1	11,095	14	53,485
Jul	145,488	2,477	.1	14,235	10	162,674
Aug	137,044	3,797	.1	19,623	8	161,231
Sep	123,435	4,073	.1	19,926	11	148,806
Oct	166,965	11,700	1.8	24,010	28	205,034
Nov	95,297	9,786	.6	13,907	20	120,438
Dec	79,646	9,454	0.4	10,338	16	100,719
TOTAL	844,104	64,515	3.2	147,759	128	1,066,371

Source: Berger, J., S. Murai, R. Nelson Jr., J. Wall. 1986. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1985, NWAFC.

Table 2.10. Percentage of 1984 and 1985 Joint Venture and Foreign Catches in the BSAI Portion of the Proposed Closure and in the BSAI Management Area, January - June

Area	**Pollock**		**P. Cod**		**A. Mackerel**		**Flatfish**		**Rockfish**		**All Groundfish**	
(Joint Ventures)	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***
Percent in Closed Area	9.9%	2.9%	35.2%	28.4%	0.0%	0.0%	2.6%	0.9%	9.3%	0.4%	10.2%	3.9%
Percent in entire BSAI	43.3%	35.6%	68.3%	55.3%	55.0%	76.2%	48.1%	45.3%	55.6%	57.2%	47.5%	41.8%
(Foreign)												
Percent in Closed Area	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	4.2%	0.1%	0.0%
Percent in entire BSAI	21.5%	11.4%	33.4%	36.0%	6.8%	3.1%	20.1%	30.9%	14.0%	27.3%	22.0%	15.7%

however, the seasonal catch distributions indicated by Tables 2.8, 2.9, and 2.10 are not representative of the current or near future fishery and may ignore species specific seasonal effects for pollock and cod.

It is likely that the foregone catch during January 1 through June 30 within Zone A could be made up outside the zone during the open season after June 30. Therefore, based on 1984 and 1985 data, a six-month closure of the block would appear to have a relatively modest impact on the joint venture cod and pollock stocks and minor impact on other stocks. The possibility exists that joint venture effort will be replaced by domestic effort or foreign effort, and, therefore, there will be little or no change in the amount of pollock or cod taken. However, given the dramatic changes in timing of the joint venture pollock harvest in 1986 and particularly 1987, the impact of a seasonal closure January-June is expected to be more severe. If most of the 590,000 mt of pollock taken by joint ventures by the end of March 1987 were harvested inside Zone A, then this closure would require a dramatic displacement of future fishing effort.

The foreign fleet would be little affected, at least in terms of catches similar to those shown by 1984 and 1985 fishery performance (Table 2.10). In terms of environmental impact to the resources in the ecosystem, the six-month closure would have less environmental impact than that described in Alternative 2 or 3.

2.3.5 Alternative 5: Impose foreign processing fees.

The imposition of fees on foreign processors receiving the catch of domestic harvesters might result in a reduction in the harvest levels of the groundfish species of the Bering Sea. This is unlikely, however, since the fees should accelerate the replacement of foreign processors with domestic processors (both shoreside and at-sea), and thus, in the long run, not result in any reduction in total harvest.

In the short run, the entire groundfish OY may not be taken, but any surplus would accrue to the populations as increases in biomass and might be used for internal ecosystem prey-predator consumption. The revised status of stocks would be considered by the Council in following years. Any environmental impact different from that under the status quo would be short term. In any case, it is expected that with the growth of "Americanization", the same amounts of groundfish as under the status quo option would be taken.

2.3.6 Alternative 6: Establish a seasonal schedule for annual release of joint venture apportionments in the BSAI.

Possible environmental impacts which could result from the imposition of seasonal quotas on joint venture pollock fisheries may fall into three main categories.

Changes in biomass of the pollock stock.

The major share of the pollock harvest in the eastern Bering Sea has shifted from foreign vessels, principally those of Japan and Korea, to domestic vessels, largely those involved in joint venture operations. This shift has been accompanied by an increasing tendency to harvest more of the pollock in the first quarter of the year, before major seasonal growth takes place. This acceleration of harvest suggests the possibility that a portion of the yield due to summer growth is being forfeited. This could have an impact on the environment by reducing the biomass of the pollock stock. To investigate this possibility, the biomass model of Ricker (1958) was converted to a quarter-year time scale. The model was run for a series of 10-year simulations, where each simulation employed a different seasonal catch distribution.

Simulations were run for 10 years under each of five different harvest distributions. The same initial biomass of 7.4 million mt, approximately equal to the current exploitable biomass level, was used to start each run. A constant recruitment of 1.0 million mt was added to the stock at the start of each year. This level of recruitment is conservative compared to the 1977-84 average of 1.6 million mt. A constant harvest of 1.0 million mt was imposed in all years of each simulation.

The five harvest distributions used in the simulation are shown in Table 2.11. Runs #4 and #5 represent the historic catch distributions observed in two fisheries for Bering Sea pollock: the Japanese foreign fishery between 1968 and 1973, and the joint venture fishery between 1983 and 1986, respectively. The quarterly instantaneous rate of natural mortality (M) was set at 0.075, corresponding to the annual rate of 0.3 given by Wespestad and Terry (1984). For the initial runs, the instantaneous growth rate (G) was also set at 0.075, keeping the stock roughly in equilibrium. This rate is approximately equal to the level of 0.082 that would be obtained by assuming the von Bertalanffy parameters given by Wespestad and Terry and length-weight parameters of alpha = 0.0075 and beta = 2.977. However, as is the case with most animals in arctic and subartic waters, the rate of growth varies seasonally.

To investigate the effects of variable growth rates on the model, the quarterly growth rates shown in Table 2.12 were used in the simulation of each of the five catch distributions. The coefficients shown in Table 2.12 are based on daily ration estimates given by Dwyer (1984). The 1986 length-frequency distribution was used to convert Dwyer's length-specific estimates into stock-wide coefficients.

The results of both the constant growth and variable growth simulations are displayed in Table 2.13. Note that the model is adjusted so that biomass remains approximately stable under run #1.

Of the five seasonal catch distributions examined, the highest biomass levels result from runs #2, #4, and #5. These scenarios correspond to an even harvest pattern and to the historical distributions observed in the foreign and joint venture fisheries, respectively. The lowest biomass gains were observed when the entire quota was taken in the first quarter (run #1), which approximates the distribution of joint venture harvest thus far in 1987. Run #3 models effects expected under a semi-annual apportionment of 50/50 with each quota taken early in the respective periods.

While these results (Table 2.13) cast some light on the problem, they are difficult to interpret because they rank only the five scenarios shown in Table 2.11; that is, they do not give a general optimum. A small modification to the model allows a more general solution to be obtained. In general, when growth of the pollock stock exceeds natural mortality, biomass will be

Table 2.11 Quarterly distribution of catch in five model runs.

Run	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
1	1.00	0.00	0.00	0.00
2	0.25	0.25	0.25	0.25
3	0.50	0.00	0.50	0.00
4	0.14	0.32	0.46	0.08
5	0.19	0.25	0.51	0.05

Table 2.12 Quarterly growth rates of pollock.

Quarter	Growth Rate
1	0.531 x G
2	0.860 x G
3	1.499 x G
4	1.111 x G

Table 2.13 Simulation results under constant and variable growth.

(% Increase column refers to change in biomass from start of simulation to end of ten-year run)

Constant Growth			Variable Growth		
Rank	Run	% Increase	Rank	Run	% Increase
1	4	16.81	1	2	13.24
2	2	16.70	2	5	11.94
3	5	16.66	3	4	11.78
4	3	5.49	4	3	2.07
5	1	0.46	5	1	0.50

maximized by harvesting the entire catch as late in the year as possible. Detailed analyses are needed which take into account age structure and variations in recruitment along with age specific growth patterns before more definitive conclusions can be reached.

Changes in reproductive potential of pollock stock.

The simple model reported above suggests that imposition of seasonal quotas on the pollock fishery would slightly increase biomass relative to a fishery taking the quota early in the year. This suggests that total reproductive potential, if reflected by total biomass, could be slightly increased if the fishery is spread out over the year. However, complete examination of this effect cannot be made without reasonable estimates of spawner-recruit relationships. Unfortunately, there is no well-defined spawner-recruit relationship for pollock.

The model cannot examine any possible behavioral changes resulting from intensive fishing operations on spawning concentrations of fish. Whether or not such operations have an effect on spawning success is unknown. It is possible that a fishery pursuing roe in a spawning concentration of fish may be able to effectively select females. The possibility that this could change the sex ratio in the population and negatively affect reproductive potential has not been examined. However, observer samples show that although some hauls may have high proportions of females catches, over the entire spawning period sex ratios are close to 50:50.

Effect on the food web.

Effects on predator-prey relationships which might be precipitated by seasonal allocations are expected to be minimal. A seasonal catch distribution with a concentration of fishing activity in the early part of the year may reduce predation on juveniles by reducing the abundance of larger predator pollock late in the year when consumption of juveniles would be highest.

2.4 Socioeconomic Impacts

2.4.1 Description and estimate of the number of small entities affected.

The numbers of harvesting vessels operating in the Bering Sea/Aleutian Islands management area and in the Gulf of Alaska for DAP, JVP, and TALFF are as shown in Tables 1.1, 1.2, 1.3, and 1.4. In this section more detail on joint ventures (Table 2.14), regional shorebased processing plants, capacity, employment, and investment (Table 2.15), and the current capability of domestic at-sea processing vessels (Table 2.16) is also provided.

It is recognized that the direct foreign fishing presence is greatly reduced and that the allocation to TALFF will soon be zero. Nevertheless, alternatives to the status quo may impact the foreign fisheries. Thus, possible economic impacts resulting from a change in foreign regulations will be examined, although the analysis will focus on impacts to the domestic fisheries.

Table 2.14 Description of 1986 and 1987 joint venture fleet.

Total Number of Vessels: 116 Average Length (ft): 96

Distribution of effort (1986)

fished for	# of vessels	avg. length
1 month	13	73
2 months	4	88
3 months	3	88
4 months	3	98
5 months	6	97
6 months	6	89
7 months	8	105
8 months	15	98
9 months	33	99
10 months	23	107
11 months	2	125

Number of vessels on the grounds, by month

	1986	1987
January	3	53
February	64	91
March	79	102

Source: NMFS-AKR

Table 2.15 Shorebased processing in the Unalaska/Akutan area: capacity, employment, investment.[a]

Plant	Location	Capacity (mt/day)	Employees	Investment[b]
Greatland	Dutch Harbor	275	50	$12
Alyeska	Unalaska	145	70	$12
Trident	Akutan	170	63	$14
		590	183	$38

a/ In terms of groundfish. Therefore, if a plant processes other species only the groundfish component is included.
b/ Initial value, in millions of dollars.

Table 2.16 1987 domestic at-sea processing requests by area.

Subarea	Numbers of Vessels	DAP Requested, mt
Bering Sea	18	102,000
Aleutian Islands	-	65,400
Total Bering Sea/Aleutians	25[a]	167,400
Total Gulf of Alaska	9	15,300

a/ Total for BSAI area. Eighteen boats indicated fishing would take place in the Bering Sea submanagement area.

2.4.2 Fishery Costs and Benefits (harvesters and processors)

Alternative 1: The status quo.

At present, the shore plants in Unalaska and Akutan are reportedly experiencing some difficulty in securing sufficient raw material for their plants on a steady basis throughout the year.

There are approximately 150 U.S. trawlers operating in the EEZ off Alaska (Tables 1.3 and 1.4). Of these, at any point in time, as many as 100 vessels operate as joint venture catcher boats (Table 2.14). Most of these vessels fish and deliver codends to at-sea processors and are not able to hold large quantities of fish on board. For vessels that have onboard hold capacity it is difficult to deliver shoreside because the vessel may not have sufficient stability to carry large volumes of fish any great distance, particularly in poor weather. A relative minority of the current groundfish trawl fleet has the physical capability to safely bring on board and transport their catch. Apparently, it is currently more profitable for those vessels to deliver to at-sea processors rather than to shoreside plants.

Although shore plants are willing to pay some 3 cents/lb above the price paid to domestic vessels fishing for joint ventures, indications are that transportation costs (the cost of getting the fish from the grounds to the plants) may be, on average, 5 cents/lb (Bert Larkins, pers. comm.).[3/] These include, for direct delivery of product by a trawler, increased fuel consumption and associated running expenses, as well as the cost associated with lost fishing time. Lost fishing time can be substantial:

(a) If the vessel is fishing a considerable distance away from the shore processing plant.
(b) If the weather is poor.
(c) If, upon return to the grounds, it takes considerable time to relocate productive schools of fish.

At-sea transfer of catch avoids much of the cost of lost fishing time but may increase other costs due to delays in processing and additional handling. This would require the purchase and operation of tendering vessels for shoreside delivery. The tendering solution implies some agreement between the buyer and seller on covering tendering costs. That cost is unknown.

A second solution is for the shoreside plants to buy or contract for trawlers that will deliver shoreside. One of the plants (Alyeska) has made such arrangements and, in early 1987, one catcher vessel was able to fully supply the daily needs of the plant. Reportedly, longer term (five-year) arrangements have also been made to secure product at the Unalaska plants.

A third solution is for the joint ventures to negotiate to assure that the shoreside demand for groundfish is met. Such negotiations are apparently being conducted.

3/ Assuming a catcher boat operates 200 days/yr, catches 100 mt pollock/day, is paid $127/mt on the grounds, has an eight-hour run in, spends eight hours unloading, and an eight-hour run out.

The first two market solutions will occur without Council action if shoreside processing is economically viable under current market conditions. The last solution may occur even if shoreside processing is not currently economically viable. Therefore, it appears that market and negotiated solutions have already, or will soon, solve the problem of shoreside plants not being able to receive adequate supplies of groundfish without direct government intervention or action.

Alternative 2: Year-round closure of Zone A.

Year-round closures of Zone A will change harvest patterns. From the point of view of the U.S. economy, the impacts of these changes take place in a step-wise fashion. First, closures of Zone A have a direct impact on the harvesting sector through changes in revenue and operating costs--the two main components of harvesting profits. Second, the changes at the harvesting level might impact the processing sectors. In the case of the foreign processors this is not relevant to the scope of E.O. 12291.[4/] The impact on domestic processors, particularly western Alaska shoreside processors, is one of the focal points of this analysis. Beyond the processing sector is a complicated network of re-processors, distributors and wholesalers. That market level can be aggregated under the heading "wholesalers". Next is the retail sector--the firms which distribute the product to the consumer, and last is the final consumption sector itself. A generalized marketing relation is depicted in Figure 2.6.

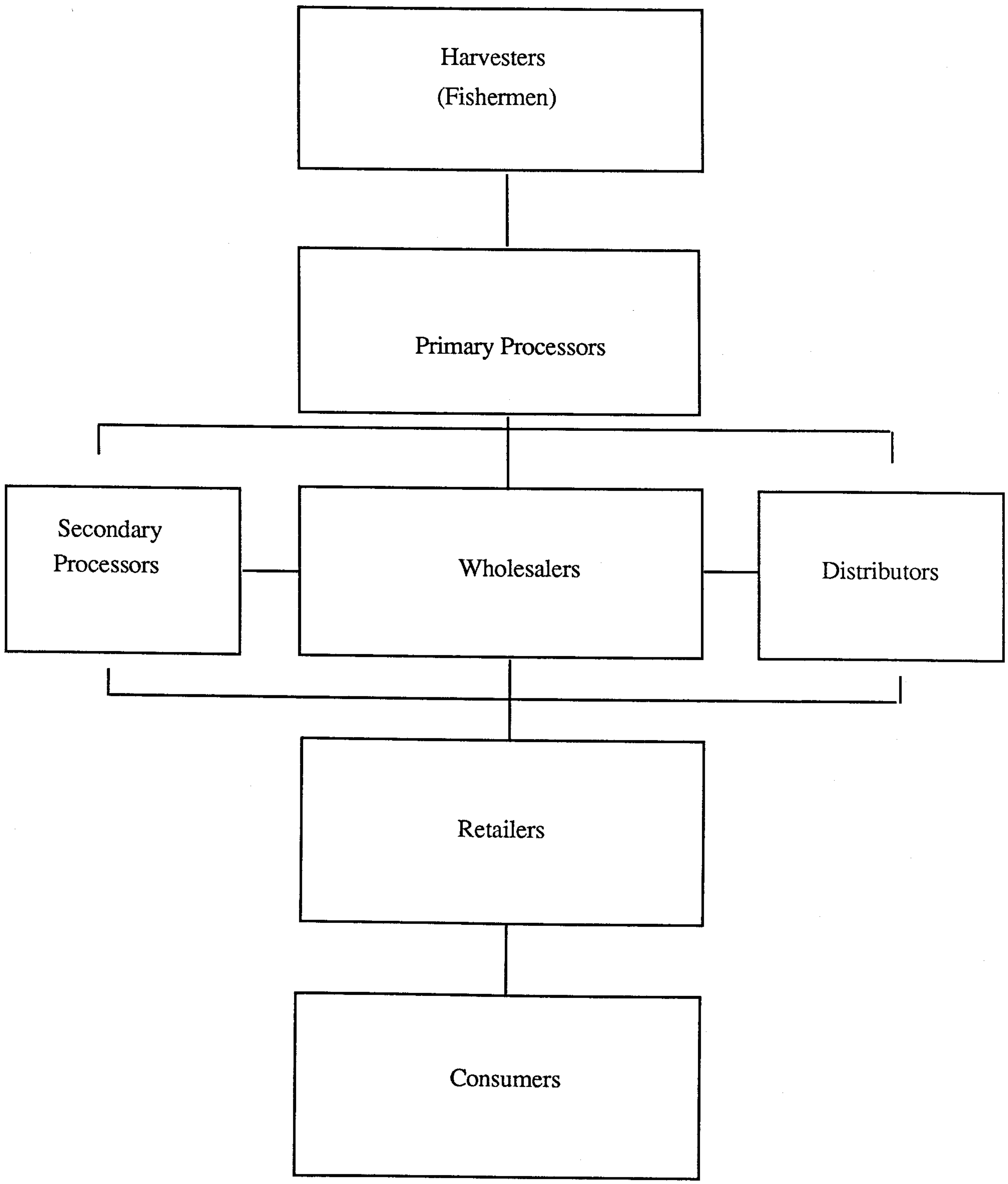
Our ability to assess the impacts of a change in fishery regulations at each of these market levels is related to the step-wise nature of marketing. Impacts on harvesters may be described, at least in terms of ranges of impacts. The impact on processors is slightly more difficult to assess as any processor may have other sources (non-Alaskan) of supply or may mitigate possible losses by focusing on non-groundfish species. Market assessments at the wholesale, retail, and consumer sector are extremely difficult because the relationship between the sectors is poorly understood and the quantitative response of each sector to quantity and price changes from other sectors is unknown. This response, which needs to be estimated for each specific market, depends on many factors outside the fishery sector, including the price and availability of products which may act as substitutes, foreign market fluctuations, including exchange rate changes, world supply factors, U.S. trade policy and general U.S. economic trends (inflation, employment, etc.).

Moreover, the market representation shown in Figure 2.6 completely ignores the geographical location of the various firms. The geographical distribution of benefits--western Alaska, other parts of Alaska, the Pacific northwest, other parts of the U.S., or outside the country altogether--is an important factor in assessing the relative merits of one alternative over another.[5/]

4/ Unless, of course, this affects the import-export relation with the country.

5/ This is not to say that efforts are not underway to develop the necessary estimating tools. Council staff, NMFS regional and NWAFC staff along with NMFS staff from other regions are attempting to improve the ability to estimate market supply and demand (the first problem) as well as develop market impact or input-output models (the second problem).

Figure 2.6. A schematic representation of production in the seafood industry.



Notwithstanding these difficulties, some assessment of impacts beyond the processing sector is possible. First, the fact that a fish is processed, distributed and consumed by U.S. firms and consumers as opposed to being exported implies a relative advantage to the U.S. seafood industry (although not necessarily to the consumer if the imported product is cheaper). Benefits to the industry are measured by the profits received by each re-seller. Unfortunately, the quantitative relationships necessary to estimate these profits (notably margins and costs) are unknown. Quantitative assessments of benefits will therefore be confined to the harvesting and processing sector. Second, it is often possible, in considering a particular alternative, to assess the geographical distribution of the economic impact, at least in an approximate way. Thus, because the proposed closure might impact the local shoreside processing facilities in Dutch Harbor/Akutan as well as domestic at-sea processors (most based in Seattle) and joint venture trawlers (most based in Seattle), some qualitative information on the distribution of benefits and costs is possible.

Closure of Zone A has potential impacts on the catch of joint venture and domestic harvesters and on the product flow and long-term viability of DAP processors. The following analysis likely overstates both the loss to joint ventures and the gains by shore processors because (1) the possibility that no catch is foregone, (2) the closure will not guarantee increased delivery shoreside nor an increased rate of Americanization, and (3) because there are efforts underway to correct the supply problem.

Harvesters

The first perspective for examination of these impacts is one of reduced exvessel gross receipts in response to the reduction in harvest. Potential revenue losses to joint ventures arising from the proposed closure are examined in Table 2.17, which present total exvessel revenue in Zone A. Assuming fisheries approximate those of 1984-85, this is a "worst case" scenario of the likely revenue impact on the joint venture harvesting sector for the reasons argued above. The opposite "best case" scenario would assume no catch is foregone and that, therefore, exvessel receipts would not decline.

The possibility of no reduction in gross receipts does not mean there is no economic impact on the fleet. That is, even the "best-case" scenario likely increases harvesting costs. This is because the displacement of the fleet from normally productive grounds to areas which may be less productive and involve greater running time from port will necessarily increase operational costs. This is not only due to increases in fuel costs because of increased running time, but also a consequence of increased "searching costs"--money and time spent locating productive grounds. Also, the distance to the new grounds or the timing of the new season may be such that some vessels will be unable to participate at all. Therefore, they may have to forego fishing opportunities that are currently available under the status quo.

As noted in a previous section, activities to redirect joint ventures outside Zone A may increase bycatch rates. If this happens it would be more difficult and potentially more costly to the joint venture fleet to remain under the bycatch limits established by Amendment 10.

Table 2.17. 1984 and 1985 Joint Venture and Foreign Gross Ex-vessel Revenue Inside and Outside the Proposed Closure, by Area ($1,000s)

Block/Area	Pollock	P. Cod	A. Mackerel	Flatfish	Rockfish	All Groundfish
(Joint Ventures)						
1984						
Closure - BSAI	4,504	2,348	0	197	40	6,631
- GOA	813	47	77	52	342	1,240
Subtotal	5,317	2,395	77	248	382	7,871
Outside - BSAI	20,382	4,380	5,427	6,526	125	35,559
- GOA	21	20	10	12	98	113
Subtotal	20,403	4,400	5,438	6,539	222	35,672
1985						
Closure - BSAI	5,923	2,532	0	224	8	8,444
- GOA	1,184	63	278	30	63	1,700
Subtotal	7,107	2,595	278	254	71	10,144
Outside - BSAI	33,718	6,507	5,717	22,924	115	67,008
- GOA	90	5	0	7	0	99
Subtotal	33,808	6,512	5,717	22,931	115	67,107
(Foreign)						
1984						
Closure - BSAI	10,223	466	33	1,037	12	12,821
- GOA	2,310	177	1	22	33	2,909
Subtotal	12,533	642	34	1,058	45	15,730
Outside - BSAI	87,741	12,348	0	23,902	231	127,878
- GOA	2,107	2,187	71	47	50	3,675
Subtotal	89,847	14,535	71	23,948	281	131,553
1985						
Closure - BSAI	11,543	196	0	465	3	13,593
- GOA	853	19	0	3	0	984
Subtotal	12,396	216	0	468	3	14,577
Outside - BSAI	74,586	12,325	0	19,320	29	108,536
- GOA	1,625	1,580	0	0	30	2,720
Subtotal	76,211	13,906	0	19,320	59	111,255

Representative costs for three sizes of joint venture trawlers catching 54 to 90 mt/day are shown in Table 2.18. If current catch rates are higher, these figures probably overestimate the current cost. Costs per metric ton of groundfish range from $88 to $95, depending on vessel size. Fuel costs constitute between 12% and 18% of total operating costs. Thus, if total fuel costs were to double because of increased running time, increased time spent fishing, increased fuel for searching, and increased fuel consumption due to changes in catch per unit of time; fuel costs may increase by as much as $15.45 per mt of groundfish harvested, increasing total operational costs by approximately 18%. The actual increase in running time would depend on the location of the pollock schools.

One important question to be answered, however, is does everything else remain equal? In particular, will CPUE change to the extent that there is a change in gross revenue, an increase in operating costs, or both, should vessels relocate to less productive grounds? This is a relevant question if vessels which would have fished in areas of high CPUE were forced to fish in areas where CPUE is expected to be much lower. Vessels would be displaced in the closure of Zone A because the total processing capacity of the shoreside plants, currently about 590 mt/day (Table 2.15), is much less than the total catching capacity of the joint venture fleet. A typical joint venture vessel has a capacity to catch 400-600 mt per day (Alaska Dragger's Association, pers. comm.), which, in terms of a fleet of 100 vessels, is about 50,000 mt/day.[6/] The daily catches of two or three operating vessels could meet or exceed the maximum processing capacity of the two Dutch Harbor shorebased plants.

If costs increase for vessels fishing for joint ventures when they are forced to move to inferior grounds, there may be a corresponding opposite positive effect accruing to those vessels that remain in the area. Any reduction in cost would accrue to domestic at-sea catcher/processors or mothership/ processors and to those domestic catchers who had previously fished for joint ventures who chose to remain in Zone A. This cost reduction is likely of a transitory nature, because as the fishery become more fully "Americanized" harvesting and processing capacity will enter the fishery to take advantage of increased catch opportunities in the zone. How quickly this might occur is unknown, but if the current rate of "Americanization" continues, the entire catch will be domestically processed in a few years. If this alternative accelerates the rate of Americanization, the cost reductions will disappear sooner. When the fishery is fully Americanized there will be no differential benefit due to access to Zone A.

It would be useful to quantify the relation between catch in a productive area versus catch in a less desirable fishing area, i.e., the "CPUE effect". Estimating this relation is too complex to be completed in the time available for analysis of this amendment. Moreover, the fundamental relations between CPUE and effort may be obscured by the natural variability in stock densities that occur throughout the year and throughout the day as schools aggregate and

6/ This may be a high estimate. Reports from the 1987 joint venture roe pollock fishery indicate maximal fishing rates of 100,000 mt/week or 1,000 mt/week per vessel.

Table 2.18 Cost structure of joint venture trawlers.

	85 ft.		108-115 ft.		120 ft.	
	$/lb	%	$/lb	%	$/lb	%
Variable Costs						
Labor	$0.015	37.5%	$0.014	33.3%	$0.013	30.2%
Fuel	0.007	17.5	0.005	11.9	0.005	11.6
Total Variable Costs	0.022	55.0	0.019	45.2	0.018	41.8
Fixed Costs						
Interest	0.002	5.0	0.003	7.1	0.004	9.3
ROI @ 30%	0.003	7.5	0.004	9.5	0.005	11.6
Insurance	0.004	10.0	0.004	9.5	0.004	9.3
Maintenance	0.006	15.0	0.007	16.7	0.007	16.3
Depreciation	0.003	7.5	0.005	11.9	0.005	11.6
Total Fixed Costs	0.018	45.0	0.023	54.7	0.025	58.1
TOTAL COSTS $/lb	0.040	100.0	0.042	99.9	0.043	99.9
TOTAL COSTS $/mt	$88.20		$92.61		$94.80	

Other Information:

	85 ft.	108-115 ft.	120 ft.
Crew size	4.02	5.02	4.95
Catch/Man/Day (lbs)	30,000	35,000	40,000
Catch/Day	121,000	176,000	198,000
Days/Fishing Year	150	190	200
Total Catch/year (lbs)	18,150,000	33,440,000	39,600,000
Total Catch/year (mt)	8,231	15,147	17,959

Source: NRC, "A Strategy for the Americanization of the Groundfish Fisheries of the Northeast Pacific," V.2, p. 128 (1985).

disperse. There is also the additional question of the relevance of such an effect when vessels are fishing at capacity, which occurs during the roe pollock fishery.

Processors

It is not certain that the proposed closure of Zone A would enhance the delivery of product to shoreside processing plants in Dutch Harbor/Akutan. The reason for this uncertainty is our inability to determine whether actions which decrease profitability for joint ventures would increase delivery to shoreside plants.

Ultimately, it is changes in costs and prices that will determine the flow of product. Suppose that the cost of delivering pollock shoreside once it has been caught is 5 cents/lb as estimated earlier. If the at-sea exvessel price is 6 cents/lb, and the cost of tendering is 4 cents/lb, and if CPUE in the zone does not change (assume vessels are fishing at capacity), then the total cost of fish delivered shoreside by a trawler is 11 cents/lb and the total cost of fish delivered shoreside by a tender is 10 cents/lb. If the shore plant pays more than 10-11 cents/lb they can attract product. If they pay less, the domestic catcher boats who might have switched to DAP will continue with joint ventures provided the joint ventures pay at least 6 cents/lb ($132/mt) and provided harvesting costs do not increase.

When faced with either the choice between delivering to a domestic processor and to a joint venture processor or the choice between delivering to a shoreside plant and not fishing, a domestic fishermen (i.e., the vessel owner or operator) will tend to take advantage of the more profitable alternative. For the first choice, the more profitable alternative is determined by exvessel prices and harvesting costs in the joint venture fishery compared to those for a vessel delivering to a shoreside plant. For the second choice, it is determined by DAP exvessel prices and variable harvesting costs. The second choice is relevant when the alternative of delivering to joint venture processors is not viable.

In general, the closure of Zone A could increase the relative profitability delivering to shoreside plants by increasing joint venture harvesting cost, decreasing joint venture exvessel prices, decreasing DAP harvesting costs, or increasing DAP exvessel prices. However, the closure is not expected to affect the last three items, so the effect of the closure on the relative profitability of shoreside deliveries would be through increased joint venture harvesting costs. If joint venture harvesting cost increases by $0.01 per pound and JVP and DAP exvessel prices do not change from the level discussed above, shoreside and joint venture deliveries would be equally profitable.

Presence of a joint venture fleet within Zone A results in potential benefits as well as costs for shoreside plants. Potential benefits include: (1) availability of a large fleet which may be able to deliver to DAP tendering vessels on a priority basis, and (2) scouting that is done by the joint venture fleet.

Assuming that the Dutch Harbor plants process the fish only into surimi, and that the Akutan plant processes all pollock into fillets, the production would be about 33.3 million pounds of surimi and 14.8 million pounds of fillets,[7/] if the three plants are supplied with pollock at capacity for six months of the year.[8/] Wholesale prices in 1986 for Japanese produced surimi were $1.40/lb structured (NMFS, ODIM, U.S. Imports). Other exporters of surimi are Korea and Taiwan, but Japan is by far the major exporter of product to the U.S. If this price is indicative of the price paid for U.S. produced product, the total wholesale revenue from the surimi produced is about $47 million. If the wholesale price for pollock fillets is $1.60 per lb ($1.45-$1.75/lb F.O.B. Seattle; March 7, 1987; Fishery Market News), the total wholesale revenue from this fillet production is $24 million and the total revenue at the wholesale level is $70 million. To determine profitability, and hence value, it is necessary to subtract the costs of producing this product. If total surimi processing costs are 97 cents/lb (Table 2.19 using 10 cents/lb for fish and 20% recovery rate), total cost is $32 million. If total fillet processing costs are 95 cents/lb (Table 2.20 using 10 cents/lb for fish and a 22% recovery rate), total cost is $14 million. Total profitability is $70 million in revenue, less $46 million in costs, or $24 million. This best-case valuation assumes that the market can absorb 33 million pounds of surimi and 15 million pounds of fillets without affecting price or demand, which is unlikely in light of recent events in the DAP surimi industry;[9/] thus, these estimates serve as an upper bound of possible profit. The benefits calculated also depend on the closure effecting a steady supply of pollock to the plants, a conclusion which cannot be guaranteed by the present analysis, and a circumstance which may be occurring regardless of management actions taken.

With respect to the impacts on the local economies of the two western Alaskan communities, an infusion of product at the levels hypothesized above would generate local economic activity. The magnitude of the impact can not be predicted without benefit of an input-output analysis, but, of the $70 million in revenue some portion would remain in the local economy. That proportion is related to the total output multiplier which is unknown for this community. At an exvessel price of 10 cents/lb, total price paid for fish would be $23 million. If none of the fishermen are local this amount would be lost to the local economy as leakage and would most likely benefit the Pacific Northwest. Labor income paid at 18 cents/lb in terms of processed product (Tables 2.19 and 2.20) would be $8.4 million. However, it is customary for these plants to hire temporary labor from outside Alaska and house and feed the employees. If this is true no labor income is spent locally. Augmenting this economic activity resulting from processing would be any activity as a result of vessel servicing, resupply, and refueling.

7/ Assuming a 20% recovery rate for surimi and a 22% recovery rate for pollock fillets.

8/ Floating procesors who process near shore (floating barges) may also benefit from such a closure. Detailed information on their capacity/location is currently unavailable.

9/ In 1986 Japan exported a total of 39 million pounds of surimi product to the U.S.

Table 2.19 Surimi processing costs, shorebased versus at-sea (cents/lb).

Cost Element	Alaska* Shoreside Plant	American* Operated Mothership	American* Catcher/ Processor	Korean Mothership	Japanese Catcher/ Processor
Fish	30-35	23-25	-	23-25	-
Other Materials					
Packaging	3	3	3	3	3
Labor	17	23	27	6	34
Fuel/Energy	1	1	4	1	4
Freight	10	10	10	10	10
Insurance	.5	.5	1.5	.5	1
Depreciation	3	2	6	2	7
Maintenance	.5	1.5	3	.5	2
Other	2	2	2	2	2
Return on Capital (16%)	10	5	16	5	18
Total	77-82	71-73	73	53	81

*Assumptions:

Annual Production Volume (millions of pounds)	23	63	24
Initial Capital cost (millions of dollars)	$13	$18	$22

Source: Natural Resources Consultants, Fletcher & Co. Analysis (Summer 1986 estimates).

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Table 2.20 Costs per pound of processing pollock fillets* (cents per pound).

Cost Element	American Factory Trawler	Alaska Shorebased Plant
Fish	---	27
Labor	28	19
Fuel and Lube/Energy	13	2
Packaging	3	3
Maintenance and Depreciation	10	6
Insurance	5	1
General and Administrative	2	4
Unloading/ Unloading Freight to Seattle	2	7
Return at 18%	19	10
TOTAL PER POUND	82	72
TOTAL PER POUND W/O 18% RETURN	63	62

*Skinless, boneless, shatterpack fillets.

Source: NRC, "A Strategy for the Americanization of the Groundfish Fisheries of the Northeast Pacific" V.2, p. 148, (1985).

At-sea domestic processors would most likely benefit more than shorebased processors from the closure if the reduced competition on the grounds results in improved catch or reduced costs or both. We are unable to quantify any such relationship. However, to the extent that floating DAP capacity replaces JVP capacity, no significant change from the current shoreside delivery problem can be expected. If at-sea processing costs are as indicated in Tables 2.19 and 2.20, domestic at-sea surimi processors have a 4-9 cents/lb cost advantage over the shore plants. It follows that either their profitability will be enhanced relative to that calculated above (catcher/ processors and mothership/ processors) or that they may be able to outbid shore plants in acquiring fish for processing (mothership/processors).

Another question to be addressed is whether shorebased plants would continue to offer a higher price than offered by foreign processors should the management actions be effective in securing delivery of product shoreside. Generally, the answer will depend on whether or not competition for vessels remains, that is, whether the joint venture catcher vessels can make up the catch foregone outside the closed area. If they can, and if foreign processors do not reduce their demand for product, the shore plants will need to maintain the price differential. If on the other hand, joint venture prices are reduced, demand for joint venture caught fish is reduced, or if there is excess fishing capacity, that is, if the closure is effective, then the shore plants will have little incentive to maintain the higher prices. Such a price reduction would reduce the profitability gains discussed above for those vessels delivering shoreside and increase profitability for the shoreside operations.

Potential losses to foreign processors have not been specifically addressed. This is because changes in foreign exvessel profit/loss are not directly relevant under the MFCMA. If those changes, however, lead in turn to changes in the import of product from or re-export of product to the United States, economic impacts on the domestic industry are expected. These import-export market effects, however, are difficult to quantify and are beyond the scope of this document.[10/]

With regard to value generated by U.S. processed product in the distribution and retail sectors, little quantitative assessment can be made. If the wholesale product can compete in price with imported product and if the market can absorb the product, additional benefits will accrue to the U.S. economy.

Alternative 3: Zone A closure to foreign processors.

In the environmental analysis section it was argued that quantitative differences between Alternative 2 and 3 are difficult to assess as the impact of the two alternatives differs to the degree that joint venture catcher boats are able to locate and harvest fish within an acceptable distance of the boundary. That ability is unknown, thus, the best-case and worst-case scenarios discussed for harvesters and processors in the preceding section are appropriate to this alternative. In a probabilistic sense, however, under Alternative 3 the likelihood of joint ventures foregoing the maximum amount of

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10/ Useful information on the world market for whitefish, in general, and cod, in particular, can be found in Queirolo (1986) and Crutchfield (1986).

catch is reduced, and the probability that the closure will result in delivery of product shoreside is also somewhat reduced, assuming boats deliver outside the zone if they fish within seven miles of the boundary. That is, the effective size of the closure is reduced by 18%.

Alternative 4: Seasonal closure of Zone A.

The kinds of costs and benefits to fishing vessels, and to shoreside and at-sea processors, are qualitatively the same as those arising from the area closures discussed in the preceding section: increased operational costs, and hence, reduced net margin for displaced boats; and potentially increased profits for the vessels remaining in the zone. The segments of the industry affected are the same. This is because the qualitative effects of a closure are the same regardless of its extent in space and time.

The quantitative aspects differ, however, according to the amount of catch foregone (Tables 2.21 and 2.22). As argued in the environmental impact section, a seasonal closure of the suggested zone would be intermediate in impact between the status quo and the year round closure alternative excludes foreign processors (Alternative 3). Thus, the preceding discussion on costs and benefits to the fishing fleet overstates the impact of a six-month closure of Zone A to joint venture and foreign fishing.

In sum, the economic impact of Alternative 3 and Alternative 4 are qualitatively the same. Short term benefits will accrue to those vessels delivering shoreside assuming an adequate price is paid to compensate for the additional cost of shoreside delivery (to the extent that shoreside capacity exists to process fish) and to domestic vessels processing at-sea. Costs will be borne by the owners and crews of joint venture vessels who are not able to deliver shoreside, or who experience increases in costs, decreases in revenue, or both, and by joint venture service companies.

In the longer term, all the Alaskan harvest will be processed domestically, with or without establishing a zone for priority access, or a seasonal closure of a portion of the Bering Sea management area. The question to be answered is, what is the best course for this Americanization--where best is taken to mean that course of action which results in the greatest stream of benefits to the U.S. economy. The answer depends on the investment climate and the relative costs of various types of operation. This last issue is the topic of the following discussion concerning the imposition of fees or assessments on foreign processors receiving product from domestic catcher vessels.

Alternative 5: Fees on foreign processors in the joint venture fishery for pollock.

Much of the analysis of the preceding alternatives has been concerned with the changes in expected harvest, either in the physical sense for the environmental analysis, or in terms of exvessel revenue for the economic analysis. In the latter case, it is important to compare the cost of foreign at-sea processing, versus domestic at-sea processing, versus domestic shoreside processing. Since the dominant fee is to be imposed on pollock processors, the comparison will focus on operational costs related to fishing for pollock.

Table 2.21. 1984 and 1985 Ex-vessel Revenue for Joint Venture and Foreign Fisheries in the BSAI Management Area, January - June. ($1,000s)

Area	**Pollock**		**P. Cod**		**A. Mackerel**		**Flatfish**		**Rockfish**		**All Groundfish**	
(Joint Ventures)	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***
Zone A	$2,463	$1,150	$2,371	$2,568	$0	$0	$173	$198	$15	$1	$4,316	$2,980
All of BSAI	$11,151	$14,577	$4,652	$5,039	$3,030	$4,569	$3,269	$10,497	$336	$107	$20,665	$32,318
(Foreign)												
Zone A	$117	$8	$46	$0	$0	$0	$12	$2	$2	$1	$175	$12
All of BSAI	$22,050	$10,104	$5,074	$5,087	$6	$0	$5,022	$6,126	$45	$9	$32,368	$19,761

Table 2.22. Percentage of 1984 and 1985 Ex-vessel Revenue Occurring in BSAI Portion of Zone A, January - June.

Area	**Pollock**		**P. Cod**		**A. Mackerel**		**Flatfish**		**Rockfish**		**All Groundfish**	
(Joint Ventures)	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***	***1984***	***1985***
Percent in Zone A	9.9%	2.9%	35.2%	28.4%	0.0%	0.0%	2.6%	0.9%	9.3%	0.4%	10.2%	3.9%
Percent in entire BSAI	44.8%	36.8%	69.1%	55.7%	55.8%	79.9%	48.6%	45.3%	204.0%	86.8%	49.0%	42.8%
(Foreign)												
Percent in Zone A	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	4.2%	0.1%	0.0%
Percent in entire BSAI	22.5%	11.7%	39.6%	40.6%	18.3%	5.0%	20.1%	31.0%	18.6%	29.4%	23.0%	16.2%

Table 2.23 The Alaska Fisheries Business Tax

Species	Processed on shore or in State waters	Other
Groundfish	1%	1.2%[a/]
Salmon	3%	
Crab	1%	

a/ There is a 1% landings tax assessed by the borough of Dutch Harbor. In addition, the Alaska Seafood Marketing Institute (ASMI) levies a fee of 0.2% on all member processors.

Source: (Harold Jones, pers. comm.)

Comparative cost information is limited but a recent study by Natural Resource Consultants (NRC, 1986) indicates that:

(a) For a pollock filleting operation, total DAP processing costs shoreside are 10 cents/lb per pound of processed product (2 cents/lb whole product) less than at-sea processing costs (Table 2.20). This cost comparison does not, however, include the cost of shoreside delivery.

(b) For surimi operations, domestic shoreside and at-sea processors have an estimated cost differential of between 4 and 9 cents per pound of processed product (Table 2.19).

(c) The Japanese catcher/processor of surimi faces costs similar to those encountered by domestic shoreside plants, while there is a substantially reduced cost for product processed by Korean motherships. The cost savings in the Korean operation are primarily a consequence of reduced labor costs; and, secondarily, a result of a lower opportunity cost of capital.

In addition to these cost differentials, Alaskan shorebased processors are assessed a processing fee based on the gross value of receipts (Table 2.23). Given fish costs of 10 cents/lb exvessel, a 2.2% tax on fish landed, the total cost of fish (ignoring transportation) to these plants may be 10.2 cents/lb (whole) or 51 cents/lb (processed), and the total processing costs 98 cents/lb. This is 45 cents more per pound than the processing costs of a Korean surimi mothership.

If the rationale for imposition of the fee is to counteract the advantage accorded to foreign processors via the combination of national subsidies and the non-imposition of costs related to the U.S. legal system (landings taxes, OSHA requirements, etc.) it is appropriate to consider only some relevant proportion of differential costs. A full analysis of the relative advantage of subsidies and the relative disadvantage of mandated costs is beyond the scope of this analysis; however, a rough approximation using information in Tables 2.19 and 2.23 shows that:

(a) U.S. processors are disadvantaged 2% to 3% due to the landings taxes alone. This translates to a differential of 1 cent/lb (for surimi processing, Table 2.23, assuming 20% conversion and 10 cents/lb exvessel) which is equivalent to an assessment of $22 per ton of processed product, or $4.40 per mt at the exvessel level.

(b) If one wished to equalize the cost of fish delivered shoreside to that of fish processed at-sea, an assessment of 6 cents/lb ($132/mt, processed; $26 per mt, exvessel) may be appropriate.

(c) Foreign processors pay the cost of observer coverage, therefore, it may be desirable to reduce the fee by that cost.

The fee structure may be uniform for all foreign processors or variable by nation. A fixed fee would seem to penalize those foreign operations already experiencing higher costs (e.g., Japanese catcher/processor) while a variable fee would "equalize" the costs of all nations. It is perhaps more logical to have a weighted average cost differential to determine the fee.

Imposition of a fee on foreign processing, whether variable or fixed, will not achieve a stable long-run solution of the stated problem. To the extent that JVP operations are forced to operate at a price equal to shoreside DAP, the only beneficiary is likely to be the at-sea DAP processing fleet. They will enjoy much lower unit costs than either DAP shoreside or JVP processing and will therefore realize greater profit. As this profitable environment becomes generally recognized new floating DAP capacity will be attracted into the fishery until all JVP and shoreside DAP is displaced. To the extent that foreign processing capacity can be "reflagged" this solution may derive almost immediately.

Operationally, the assessment estimation and collection procedures could be handled in the same way that the current fees on directed foreign fishing operations are administered.

The imposition of Alternative 5 does have downstream price implications--the new cost structure may affect the basic market pricing mechanisms, potentially raising prices at the secondary processing, wholesale and retail levels. Price responses will depend on the willingness and ability of the seller to pass on cost increases (i.e., the relative price elasticities of supply and demand). These price responses, however, cannot be easily predicted.

Alternative 6: Seasonal apportionments to joint ventures.

One stated objective of the proposed DAP priority measure is to assure a steady supply of groundfish to local shoreside processing facilities in the communities of Unalaska/Dutch Harbor and Akutan. Seasonal apportionments were suggested at the March Council meeting as a means of meeting that objective.

Federal criteria for proposed regulations require that the objectives be achieved at minimum cost to the industry. This section considers the ability of two proposed semi-annual JVP apportionments to assure domestic shoreside processors a steady supply of groundfish, and if so, the costs to domestic harvesting vessels. The two apportionments considered are: (1) 50% in the first half and 50% in the second half of the year with any balance in the first apportionment carried over to the second season; (2) 0% and 100% in the first and second half of the year, respectively.

Harvesters

Analysis of the effects of the seasonal apportionments requires selection of a base period to be used as the status quo. Table 2.2 provides joint venture catch distributions for 1983-1986 and 1986, and Table 2.3 presents the pattern of effort in the first quarter of 1987. A 50/50 apportionment scheme would not alter the status quo if either the 1983-86 or 1986 distribution were chosen as a baseline. A 0/100 apportionment would have precluded 44% and 48% of the catch in 1983-86 and 1986, respectively, assuming fishermen did not make up the catch foregone in the second season. If the 1987 catch distribution is used as the status quo, both proposed apportionments would force the joint venture fleet to alter current fishery patterns. A 50/50 apportionment in 1987, assuming no adjustment on the part of the joint venture fishermen, would have closed joint venture pollock fishing in the first week of March. A 0/100 apportionment would have displaced the entire fishery to the second half of the year since projections are that the entire 1987 joint venture pollock quota may be taken by July 1.

Assuming operators minimize costs, seasonal apportionments that alter the current pattern of effort will increase costs. The magnitude of impact to the domestic fishing fleet depends on the decisions operators make when the joint venture quota is no longer available. Under the status quo (1987) operators would be required to find alternative activities after the quota is taken, that is, from July to December. Alternative activities could take the form of: (1) switching to other target fisheries (e.g., flatfish/yellowfin sole), (2) delivering to domestic processors, or (3) not fishing. It is not possible to predict the response of vessel owner/operators as it is a decision specific to the individual vessel which is dependent upon that vessel's costs per unit of catch, preferences of the captain/owner, and market prices. Note that, in the immediate future, delivery to domestic processors will only be possible for a few vessels.

With regard to switching to the flatfish fishery, flatfish joint venture fishermen harvested the yellowfin sole quota before the end of September in 1986. A major shift in effort from pollock to this fishery would cause this quota to be taken in a shorter period of time, thus redirection of effort to this fishery would offer only a temporary solution. Furthermore, the yellowfin sole fishery takes a substantial amount of pollock (10% of the target catch or 17,000 mt in 1986). Harvest of this pollock, when seasonal pollock apportionments are attained, needs to be considered in the implementing regulations.

Domestic processing capacity is such that demand could be satisfied by a small number of domestic trawlers. There are, at any one time, approximately 100 U.S. trawlers delivering to foreign processors. Shoreside plants could employ on the order of 5 or 6 catcher vessels. Available data indicates there are currently three domestic mothership/processors operating in the area with each receiving fish from two to three trawlers. Therefore, delivering to domestic processors, at least in the short term, is not a viable alternative for approximately 90-95 domestic trawlers. Also, if the harvesting vessels cannot recover variable costs from alternative fishing activities, they might cease operations for that period.

A 50/50 semi-annual apportionment schedule would create two distinct joint venture pollock seasons. Joint venture fishermen would be able to harvest a large share of the concentrated roe-bearing pollock and, thus, take advantage of the higher catch rates and higher product value associated with the roe fishery. If the second quota is taken before the end of the year, operators would need to choose among alternative activities or experience costly idleness twice during the year.

Costs may be incurred by domestic fishermen delivering to foreign processors due to lower catch rates under the 50/50 apportionment. If vessels change fisheries, there are potential costs from gear conversions, crew changes, and lost fishing time. These costs would be incurred at least twice a year if vessel operators fish both joint venture pollock openings. If vessel operators cease fishing during the April-June period, there would be costs from laying up vessels and transfering crews and supplies. However, catch rates would increase the total number of days necessary to harvest the quota and thus the vessels' operating costs.

A 0/100 seasonal apportionment scheme, had it been in effect in 1987, would have redirected most if not the entire 1987 joint venture pollock fishery to the second half of the year. The pollock roe fishery would thus no longer be available to joint venture fishermen. Joint venture pollock fishermen would need to find alternatives to the pollock fishery in the first half of the year, as opposed to the second half under the status quo, or face a costly period of inactivity. This apportionment schedule could also decrease prices received if the value of pollock roe is factored into the price paid to joint venture fishermen. Increased costs associated with longer required fishing time due to decreased catch rates would also occur. There could be substantial vessel unemployment in the first half of the year if the flatfish joint ventures and domestic processors could not absorb effort displaced from the pollock fishery. However, the extent of negative effects resulting from this unemployment as opposed to potential unemployment in the second half of the year from continuing the status quo is uncertain.

Apportionments more frequent than semi-annual would qualitatively impact the harvesting sector as described above. However, the shorter the season, the greater the number of start-ups, shutdowns and the greater the costs to harvesters and processors.

Processors

It is not apparent whether seasonal apportionments would provide shoreside processors a steady supply of pollock. The probability of steady supply would vary with the frequency and distribution of apportionments. Any increase in deliveries to shoreside processors is dependent upon the decisions made by domestic vessels as to alternative activities when there is no joint venture pollock quota available. Whether shoreside price is sufficient to sustain profitable operations is also dependent upon whether fish exist in sufficient quantities during the period in question in waters near Unalaska Island.

At-sea domestic processors (including catcher/processors) would be most likely to benefit from a situation in which joint venture effort is limited if reduced competition on the grounds resulted in improved catches, increased deliveries, or reduced costs. Any such relationship is difficult to quantify. However, to the extent that floating DAP capacity replaces joint venture processing capacity, there may be no significant change in existing shoreside supply patterns.

Under the 50/50 apportionment, domestic processors would have exclusive purchasing rights from perhaps the first week of March until the end of June (based on 1987 performance). The decreased level of competition during that time could enable domestic processors to purchase pollock at a lower price and thus enjoy increased profits. This period of exclusive purchasing might enable shoreside processors to take advantage of the last days of large concentrations of pollock near Unalaska Island provided that floating DAP processors do not intercept their deliveries and assuming vessels or tenders are available for shoreside delivery.

The 50/50 apportionment scheme may also impose some costs on domestic shoreside processors. The total number of days annually in which DAP has of exclusive purchasing rights may be reduced relative to the status quo. To illustrate, assume the last of the 1987 joint venture quota is taken on May 31.

This would leave 214 days when domestic processors would be the exclusive purchasers of pollock. If joint ventures had begun fishing January 1, the 1,010,013 mt quota would have been taken at a rate of 6,689 mt/day. If catch rates were 25% lower in the period from June 1 to December 31 (5,017 mt/day) the joint venture quota would be taken in 201 days. Therefore, the total number of days domestic processors would enjoy exclusive purchasing rights would decrease from 214 to 164. This result follows from any redistribution which results in a decrease in average daily catch rates. Furthermore, the split seasons may increase the number of disruptions in shoreside deliveries due to the multiple joint venture pollock openings. If shoreside processors were unable to secure consistent deliveries during these openings, they could incur substantial costs from employment disruptions as well as increased operational costs associated with start up and shut down procedures.

The 0/100 apportionment would provide shoreside processors with the greatest bargaining strength at that time of the year when stocks are in high concentrations and in close proximity to shoreside plants. This competitive advantage, however, could be completely dissipated by an increased level of processing by DAP at-sea processors. Also, shore plants may find it difficult to secure vessels after July 1 when joint ventures begin operations anew upon stocks that are then more widely distributed.

In conclusion, seasonal apportionment, particularly the 0/100 split, could provide shoreside plants with a steady supply of groundfish during that time of year when roe-bearing pollock are in large concentrations near Unalaska Island, at least in the short-term, if the available supply is not preferentially captured by domestic at-sea processors. However, this alternative imposes costs, possibly substantial, on joint venture harvesters. Unfortunately, any benefits to shore plants of seasonal joint venture apportionments will disappear as at-sea domestic processing replaces at-sea foreign processing.

2.4.2 Reporting Costs

The closed zone alternative(s) or the closed season approach may require imposition of new check in/check out procedures for all fishing vessels. If the reporting burden is placed on the foreign processing vessels existing regulations should suffice. Imposition of fees on foreign processors will not require any changes in the status quo reporting requirements for domestic operators.

2.4.3 Administrative, Enforcement, and Information Costs and Benefits

The administrative cost of the area closure relates to the cost of any reprogramming on the part of the observer program and PacFIN. These costs are not likely to be substantial. The administrative cost of year-round or seasonal closures of Zone A to joint venture and/or foreign fishing (Alternatives 2-4 and Alternative 6) will be minimal. In fact, it may be possible to realize some cost savings. With regard to the fee alternative (Alternative 5), the administrative costs of imposition will also be minimal if the procedures adopted are identical to that used currently for the directed foreign fisheries. If a separate program is established to determine and collect assessments, administrative costs could be substantial. The information cost of establishing the appropriate fee schedule could also be considerable.

The enforcement costs of the proposed closures depend on the wording of the implementing regulations. If the regulations are written such that the closed areas are declared off limits to foreign processing vessels (Alternatives 3 or 4) enforcement costs will not increase greatly. If, on the other hand, Alternative 2 is chosen, enforcement will be extremely difficult and additional effort or new procedures may be necessary to ensure compliance. Note that the size and shape of the area has little effect on enforcement costs. Enforcement of the fee collection alternative should not increase significantly over status quo costs, assuming, as above, that the program is a supplement to the existing foreign fee program administered by NMFS.

2.4.4 Impact on Consumers

If the price paid by re-processors of blocks (especially pollock, but also cod) increases because of constriction in supply (due to the reduced catch from joint ventures) or because of increases in costs (CPUE declines, per ton assessments) then consumers will suffer a loss. The magnitude of this loss will depend on the price response of the consumer demand curve and the magnitude of the price shift, as well as to the availability of substitutes. Changes in product level at the U.S. national retail level are expected to be modest in relation to the U.S. market for whitefish products. Significant changes in the supply of pollock for surimi or substantial price shifts for either raw product or primary surimi could have a major impact on the U.S. markets for analog products.

2.4.5 Redistribution of Costs and Benefits

All the alternatives described above may benefit the western Alaskan communities which participate in shorebased processing, at least in the short run, if those closures or fees result in more product being delivered shoreside. If more fishing, transport, and processing vessels visit those ports to purchase fuel, supplies, and for service and maintenance the local economies will further benefit. If fewer joint venture harvesting vessels use these ports for servicing, then local revenues may decrease. All alternatives would likely benefit the domestic at-sea processing component through competitive advantage or if catches increase in the closed area. All alternatives harm joint venture operations to some extent. The magnitude of these gains and losses will depend, of course, on the magnitude of the catch reduction and the cost of vessel displacement from the zone.

2.4.6 Cost-Benefit Conclusion

It is apparent from the discussion above that precise estimates of benefits and costs are not possible. However, several conclusions are drawn from available information:

- Adopting any of the five alternatives to the status quo could have significant negative economic impact on domestic fishermen fishing for joint ventures. It is uncertain that any of the five alternatives will benefit DAP, particularly shoreside processors, to a greater extent than would continuation of the status quo.

- Complete "Americanization" of the groundfish fisheries will substantially benefit the Alaskan, Pacific Northwest, and overall U.S. economy, but the difference in the rates of Americanization among the status quo and alternatives to the status quo cannot be determined.

- It has been the case in most all economically viable fisheries that full development is soon followed by overdevelopment (overcapitalization). This probably will occur soon for the joint venture fisheries if it has not already. This suggests that vessels will soon be or are already available for any economically viable DAP fishery.

- The major competition to shoreside processing plants will probably be domestic at-sea processing vessels. Therefore, alternatives to the status quo may only provide, at best, temporary benefits to shoreside plants. If this is the case, any alternative which encourages shoreside development cannot be sustained indefinitely.

- If any alternative is effective in providing benefits to some portion of the U.S. economy, it is optimal to choose that alternative which imposes the least cost on other portions of the U.S. economy. Given that it is not possible to determine any superior alternative with regard to benefits, one should avoid alternatives that impose high costs. Seasonal allocation of pollock to joint ventures (Alternative 6), particularly under a 0/100 apportionment schedule, could impose substantial costs on joint venture catcher vessels. Likewise, the year-round closure of Zone A (Alternative 2) has high potential cost to joint venture operations. The least cost alternative may be the status quo.

- Seasonal apportionments of pollock to joint ventures (Alternative 6) will, in all likelihood, create some window of exclusive DAP priority access. Whether DAP shorebased plants would benefit from that preferential access is indeterminate. A preliminary environmental analysis indicates some potential yield gains from harvesting later in the year. It is possible that a delayed harvest also improves reproductive potential. Potential yield gains will continue to be a topic of active research by the NWAFC.

REFERENCES

Berger, J., R. Nelson Jr., J. Wall. 1985. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1984, NWAFC.

Berger, J., S. Murai, R. Nelson Jr., J. Wall. 1986. Summaries of Provisional Foreign and Joint Venture Groundfish Catches (Metric Tons) in the Northwest Pacific Ocean and Bering Sea, 1985, NWAFC.

Crutchfield, J., 1986. The Japanese cod market and U.S. Allocations, Natural Resources Consultants, Seattle, WA 39 pp. with appendix.

Dwyer, Deborah A., 1984. Feeding habits and daily ration of walleye pollock (Theregra chalcogramma) in the eastern Bering Sea. Ms thesis, University of Washington, Seattle. 102p.

Natural Resources Consultants, "A Strategy for the Americanization of the Groundfish Fisheries of the Northeast Pacific," V.2, p. 128 (1985).

Queirolo, L.E., 1986. An assessment of current world cod resources and markets, with an emphasis on Japan and the United States, unpub. mss. 26 pp.

Ricker, W. E., 1958. Handbook of computations for biological statistics of fish populations. Bull. Fish. Res. Bd. Can. 119. 300 p.

Wespestad, V. G., and J. M. Terry, 1984. Biological and economic yields for eastern Bering Sea walleye pollock under differing fishing regimes. North American Journal of Fisheries Management 4:204-215.

APPENDIX A

Foreign Annual Catch Distributions of Cod and Pollock (1982-85)

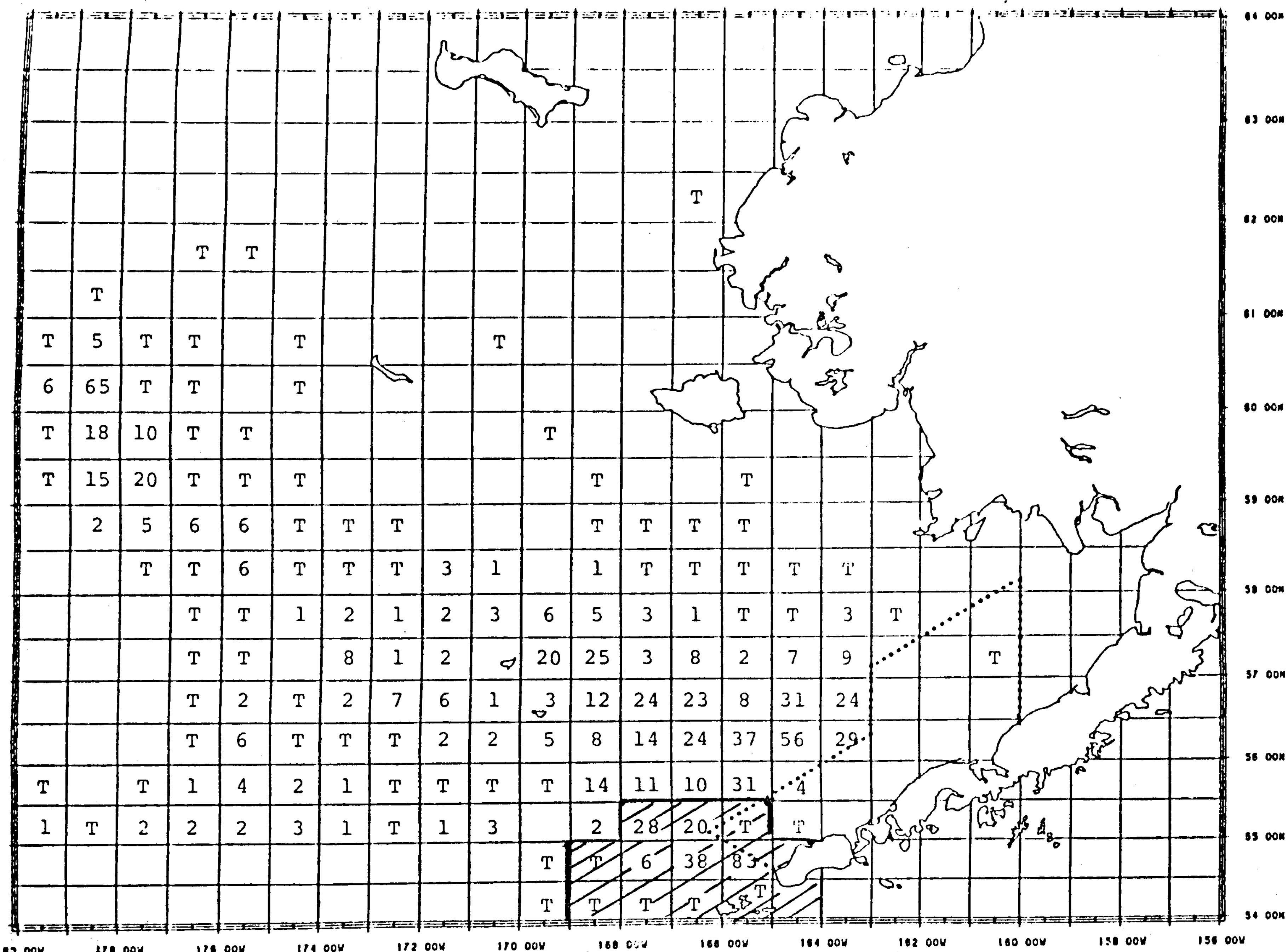


Figure 8.--Foreign-reported catch (thousands of metric tons) of walleye pollock in 1982.
T = less than 500 t.

SLASHED AREA INSIDE 100-MILE ZONE

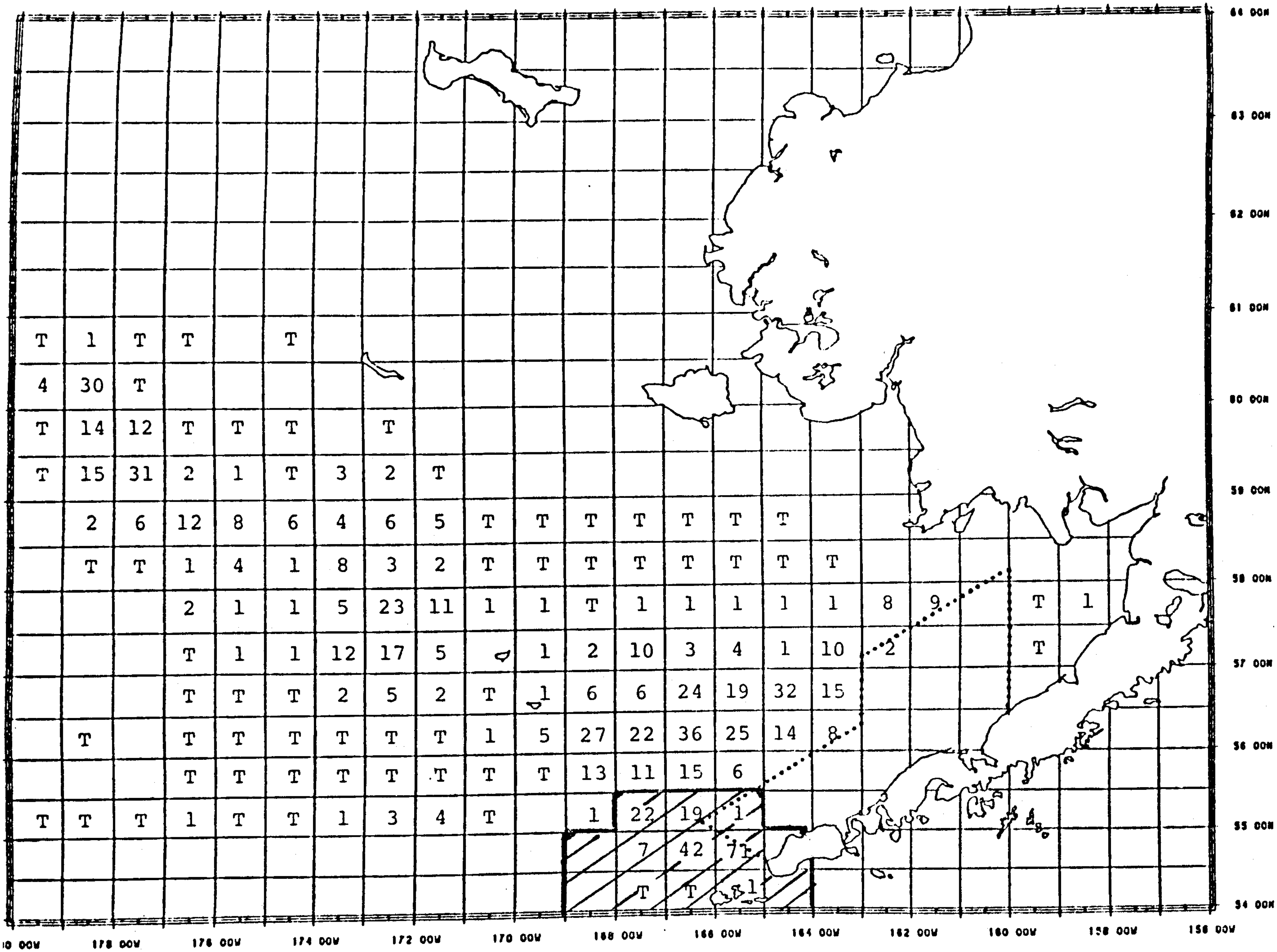


Figure 9.--Foreign-reported catch (thousands of metric tons) of walleye pollock in 1983.
T = less than 500 t.

ASHED AREA INSIDE 100-MILE ZONE

1984 Foreign Pollock catch by Trawl Fishery - Section 1

1984 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1   GEAR CODES 1 2 3 6 0 0 0 0 0 0
EASTERN BERING SEA - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA)

SUETJ/124
TOTAL = 835[illegible]59.

	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	
643	0	0	0	0****	****	****	****	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	643
640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	640
633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	633
630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	630
623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	623
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	****	620
613	0	0	0	1326	336	0	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	****	****	613
610	0	9	1033	5667	2214	6	0	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	****	610
603	488	2713	2464	6431	3277	480	7	1	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	603
600	378049911		2227	3563	4502	2746	21	67	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	****	****	600
593	41503814515			225	40771012012152			3505	5	25	0	0	0	0	0	0	0	0****	****	****	****	****	****	****	593
590	71324926301			583	1250336187496422877				16	193	3	0	0	0	0	0	0	0****	****	****	****	****	****	****	590
583	0	1545	4906	6358	4730176824305661296				5361	203	303	87	2	12	55	82	9	0	0	0	0	0****	****	****	583
580	0	0	220	66	4333	202	97863601716332			1352	231	289	87	144	83	143	127	0	19	0	0	0	0****	****	580
573	0	0	0	5	0	1820	2068	3585	2550	0	0	74	195	211	2174	3285	2478	217	0	0	0	0	0****	****	573
570	0	0	0	0	75	280	3827	415	2	13	549	1808	259	614	785	519113016		382	0	18	1	0****	****	****	570
563	0	0	0	0	2	29	1808	1956	336811940		1892	1973	1435	793	1327	1590	4176	101	0	0	7****	****	****	****	563
560	0	0	0	0	85	132	34	5	680	315112898		6991	6220	2793	528314024		6743	0	0	0****	****	****	****	****	560
553	94	89	136	67	754	209	116	1	3	34	68411406		337	2207	3247	3140	0	0	0****	****	****	****	****	****	553
550	18	127	553	1837	8274	6118	50	196	0	0	0	2991	9224	2390	1043	198	0	0****	****	****	****	****	****	****	550
543	****	****	****	****	****	****	****	****	****	****	234	141	62944243849799			331****	****	****	****	****	****	****	****	****	543
540	****	****	****	****	****	****	****	****	****	****	0	74	150	1133	56****	****	****	****	****	****	****	****	****	****	540
533	****	****	****	****	****	****	****	****	****	****	0	0	442****	****	****	****	****	****	****	****	****	****	****	****	533
530	****	****	****	****	****	****	****	****	****	****	0	0****	****	****	****	****	****	****	****	****	****	****	****	****	530
523	****	****	****	****	****	****	****	****	****	****	11	0****	****	****	****	****	****	****	****	****	****	****	****	****	523
	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	

Section - 2

1984 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124
WESTERN BERING SEA - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA) TOTAL = 518.

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	
643	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	643
640	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	640
633	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	633
630	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	630
623	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	623
620	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	0	620
613	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	0	0	613
610	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	0	0	0	0	610
603	***	***	***	***	***	***	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	603
600	***	***	***	***	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600
593	***	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	593
590	***	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	590
583	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	583
580	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580
573	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573
570	***	***	***	***	***	***	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	570
563	***	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	563
560	***	***	***	***	***	0	0	0	0	0	0	0	0	220	0	0	0	0	0	0	0	0	0	0	560
553	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	0	0	553
550	***	***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	216	550
543	***	***	***	***	***	0	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	543
540	***	***	***	***	0	0	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	540
533	***	***	***	***	0	0	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	533
530	***	***	***	0	0	0	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	530
523	***	***	0	0	0	0	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	523
	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	

Section 3

1984 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0
ALEUTIAN ISLANDS - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA)

SUETQ/124
TOTAL = 67?96.

	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	
553	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
550	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	553
543	*****	*****	0	C	0	0	0	0	0	0	0	112	219	47	202	199	512	5197	234	113	51	14***	*****	*****	550
540	*****	*****	0	C	0	12	0	0	0	0	0	0	275	659	196	524	2453	10354	359	57	533	346***	*****	*****	543
533	*****	*****	0	0	0	33	0	0	C	0	0	0	0	154	13	184	465	4681	1654	5665	2119	110***	*****	*****	540
530	*****	*****	1	C	0	70	0	0	0	0	0	0	0	0	0	0	0	229	325	711	24	560***	*****	*****	533
523	*****	*****	1	1	3466	0	96	0	0	0	0	17	37	0	0	0	0	49	0	30	3261	2249***	*****	*****	530
520	*****	*****	0	C	204	595	54	4	80	28	7	213	1	0	0	0	0	0	0	0	16149	306***	*****	*****	523
513	*****	*****	0	0	0	0	0	22	0	139	281	37	0	0	0	0	0	0	0	0	61	0***	*****	*****	520
510	*****	*****	0	C	0	0	0	0	C	0	20	22	3	0	0	0	0	0	0	0	1	0***	*****	*****	513
503	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	*****	*****	510
500	*****	*****	0	C	0	0	0	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0***	*****	*****	503
493	*****	*****	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	*****	*****	500
490	*****	*****	0	C	0	0	0	C	0	0	0	0	0	0	0	0	0	0	0	0	C	0***	*****	*****	493
	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	490

1985 Foreign Pollock catch by Trawl Fishery-Section - 1

1985 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 C1 GEAR CODES 1 2 3 6 0 0 0 0 0 0
EASTERN BERING SEA - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA) SUETO/124 TOTAL = 782937.

	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	
643	0	0	0	0	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	643
640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	640
633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	633
630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	630
623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	623
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	620
613	0	0	0	960	880	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	613
610	0	0	1180	10753	9648	2828	1015	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	610
603	457	2114	10893	13098	19451	8658	40	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	603
600	6092	7100	7955	19256	23530	31218	1444	46	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	600
593	2	4613	6549	10988	16132	17841	14395	4513	2	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	593
590	11	6108	11826	1357	7509	11063	20337	21891	345	5	1	0	0	0	0	0	4	0	*	*	*	*	*	*	590
583	0	1333	3462	5218	4440	5285	18903	24828	1719	212	169	12	8	36	59	87	9	0	0	0	0	0	*	*	583
580	0	0	12	56	4779	2445	10578	16373	5547	16	167	160	123	202	119	37	107	16	6	0	0	0	0	*	580
573	0	0	0	65	213	342	1924	21231	998	2	11	163	217	494	253	874	1014	896	523	0	1	0	0	*	573
570	0	0	0	0	0	106	4805	3251	5567	428	3480	1646	150	1021	828	5824	10634	286	2	0	31	0	*	*	570
563	0	0	0	24	0	23	2364	6607	6850	7948	5396	4178	49	591	3900	11402	24793	0	0	0	26	*	*	*	563
560	0	0	0	0	0	40	45	0	990	991	5301	9096	392	211	2714	14608	15689	120	0	0	*	*	*	*	560
553	168	92	0	102	420	16	0	215	2	9	3007	5730	837	23	1419	1523	272	0	0	*	*	*	*	*	553
550	221	167	5177	1573	643	170	50	0	101	38	0	213	1338	2293	378	24	0	0	*	*	*	*	*	*	550
543	*	*	*	*	*	*	*	*	*	*	0	92	22173	20547	3286	124	*	*	*	*	*	*	*	*	543
540	*	*	*	*	*	*	*	*	*	*	0	0	229	1354	544	*	*	*	*	*	*	*	*	*	540
533	*	*	*	*	*	*	*	*	*	*	0	21	38	*	*	*	*	*	*	*	*	*	*	*	533
530	*	*	*	*	*	*	*	*	*	*	0	0	*	*	*	*	*	*	*	*	*	*	*	*	530
523	*	*	*	*	*	*	*	*	*	*	0	0	*	*	*	*	*	*	*	*	*	*	*	*	523
	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	

Section - 2

1985 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETJ/124
WESTERN BERING SEA - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA) TOTAL = 2250.

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	
643	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	643
640	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	640
633	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	633
630	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	630
623	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	623
620	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	620
613	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	613
610	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	610
603	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	603
600	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600
593	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	593
590	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	590
583	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	583
580	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580
573	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573
570	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	570
563	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	563
560	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	560
553	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166	326	798	0	0	553
550	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	26	0	465	406	550
543	*	*	*	*	*	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	543
540	*	*	*	*	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	540
533	*	*	*	*	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	533
530	*	*	*	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	530
523	*	*	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	523
	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	

Section 3

1965 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124

ALEUTIAN ISLANDS - CATCH OF WALLEYE POLLOCK (THERAGRA CHALCOGRAMMA) TOTAL = 48701.

	268 269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169 168	
553	**********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	**********	553
550	**********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	**********	550
543	**********	0	0	0	0	0	0	0	0	0	13409	3810	0	150	0	35	0	695	19	0	21	**********	543
540	**********	0	0	0	0	0	0	0	54	0	174	4537	69	0	87	64	3655	3052	140	197	111	**********	540
533	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2377	869	2198	3119	59	**********	533
530	**********	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	826	864	711	**********	530
523	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6599	736	**********	523
520	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	**********	520
513	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	**********	513
510	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**********	510
503	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**********	503
500	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**********	500
493	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**********	493
490	**********	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**********	490
	268 269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169 168	

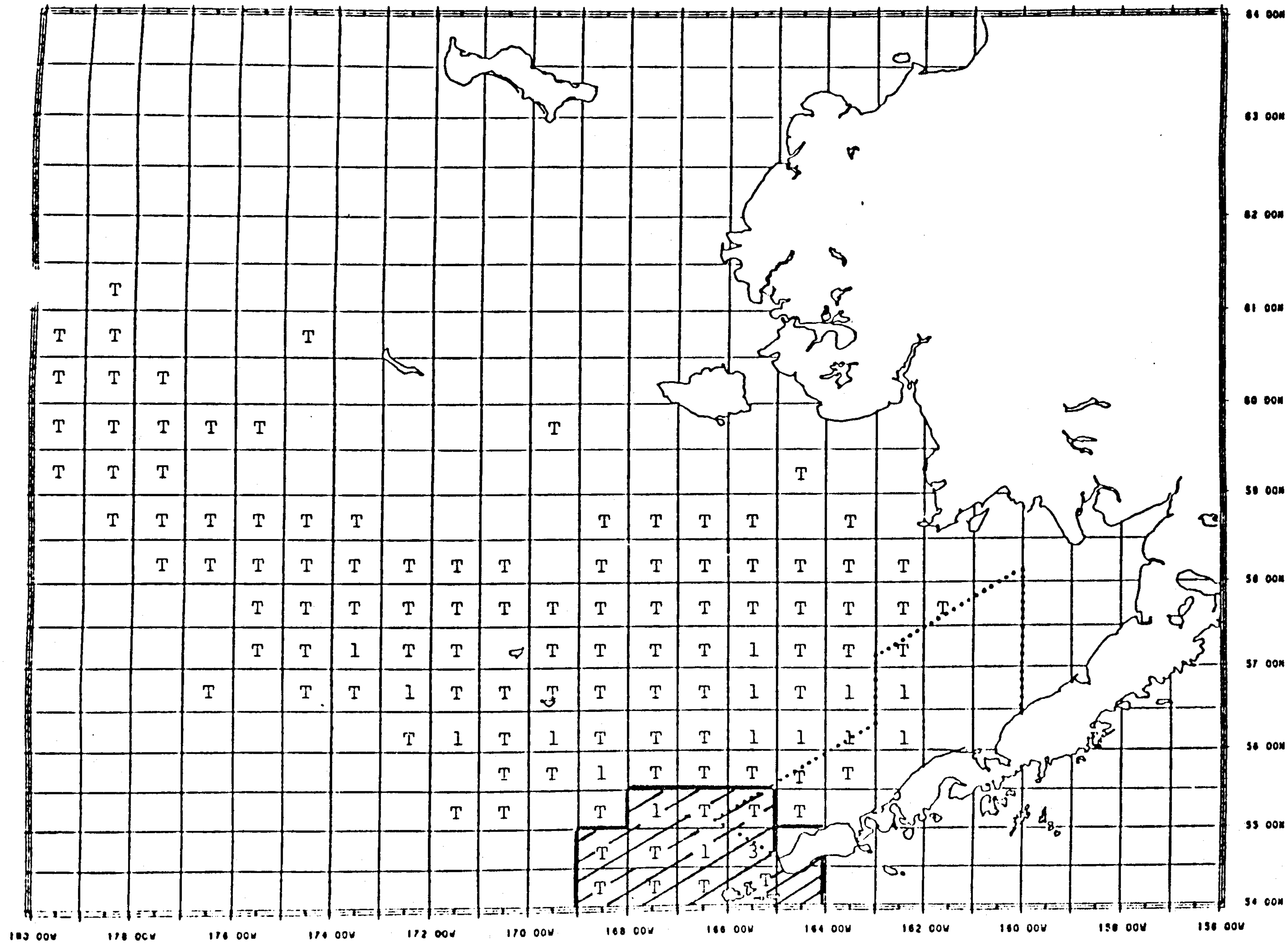


Figure 13.-Foreign-reported catch (thousands of metric tons) of Pacific cod in 1982

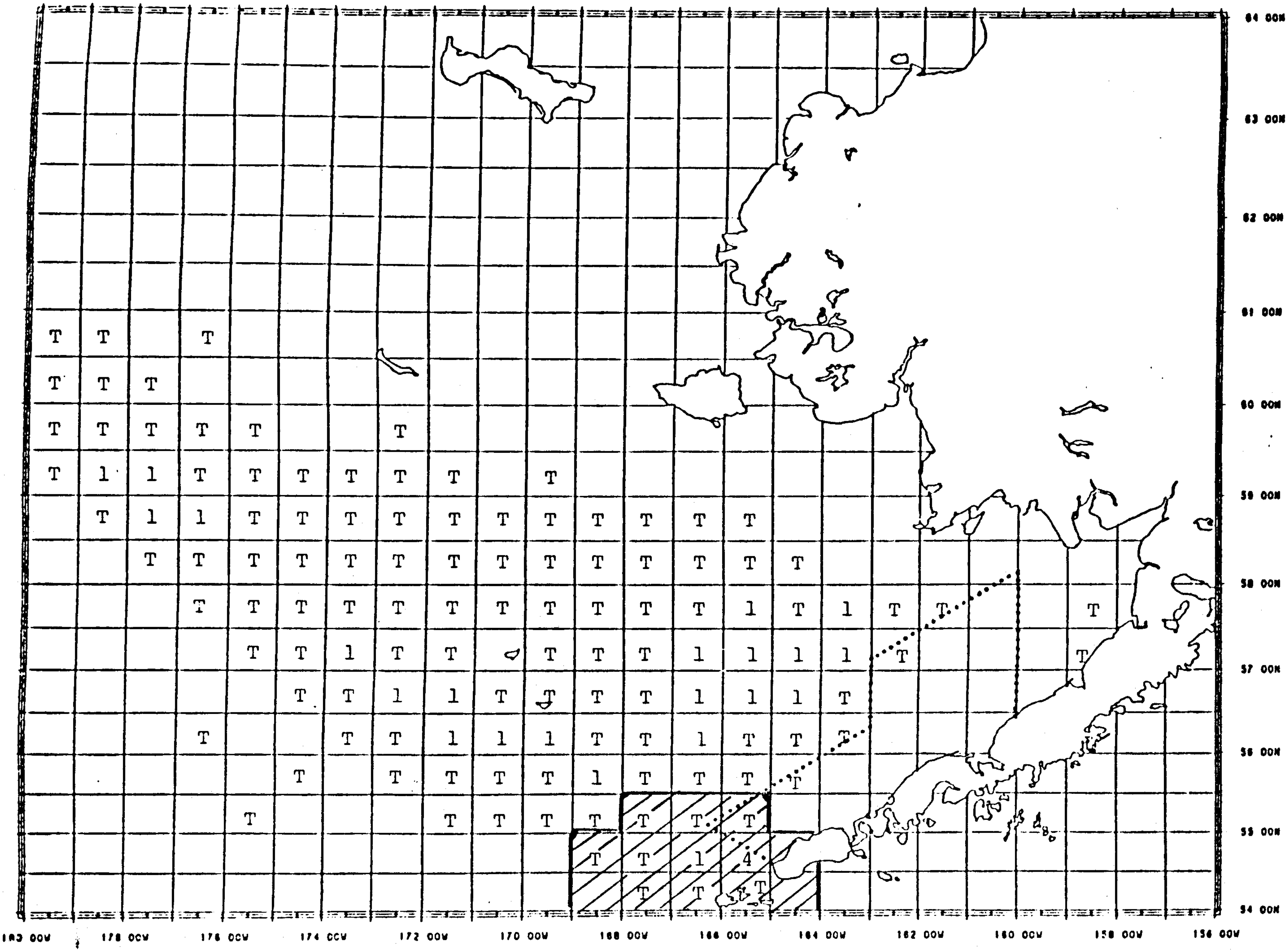


Figure 14. -Foreign-reported catch (thousands of metric tons) of Pacific cod in 1983.
T = less than 500 t.

SLASHED AREA INSIDE 100-MILE ZONE

1984 Foreign Pacific Cod by Trawl Fishery- Section - 1

1984 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0
EASTERN BERING SEA - CATCH OF PACIFIC COD (GADUS MACROCEPHALUS) (MT).

SUETO/124
TOTAL = 26670.

	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	
643	0	0	0	0***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	643
640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	640
633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	633
630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	630
623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	623
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	620
613	0	0	0	13	3	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	***	613
610	0	6	8	63	29	1	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	610
603	249	668	29	82	31	8	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	603
600	46	842	87	36	42	17	0	1	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	600
593	4	520	188	3	55	114	93	27	1	2	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	593
590	0	434	328	20	23	624	1043	319	7	59	2	0	0	0	0	0	0	0***	***	***	***	***	***	***	590
583	0	224	520	217	189	361	849	1047	68	71	225	69	8	16	65	402	32	0	0	0	0	0***	***	***	583
580	0	0	4	3	191	60	196	732	251	42	304	373	92	204	81	378	258	0	9	1	1	0	0***	***	580
573	0	0	0	0	0	51	114	74	61	0	1	15	196	107	784	797	1279	147	0	1	23	1	0***	***	573
570	0	0	0	0	0	4	197	6	3	1	11	92	18	186	234	612	1890	114	0	0	152	0***	***	***	570
563	0	0	0	0	0	0	115	192	89	205	21	91	129	233	627	177	374	1	0	0	93***	***	***	***	563
560	0	0	0	0	0	0	8	7	62	203	527	107	61	118	91	237	84	0	0	0***	***	***	***	***	560
553	0	0	0	0	0	0	0	0	0	0	5	249	1	35	55	101	0	0	0***	***	***	***	***	***	553
550	0	0	0	0	0	0	0	0	0	0	0	15	73	44	30	4	0	0***	***	***	***	***	***	***	550
543	***	***	***	***	***	***	***	***	***	***	0	2	26	351	918	9***	***	***	***	***	***	***	***	***	543
540	***	***	***	***	***	***	***	***	***	***	0	0	1	12	4***	***	***	***	***	***	***	***	***	***	540
533	***	***	***	***	***	***	***	***	***	***	0	0	8***	***	***	***	***	***	***	***	***	***	***	***	533
530	***	***	***	***	***	***	***	***	***	***	0	0***	***	***	***	***	***	***	***	***	***	***	***	***	530
523	***	***	***	***	***	***	***	***	***	***	1	0***	***	***	***	***	***	***	***	***	***	***	***	***	523
	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	

1984 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124
WESTERN BERING SEA - CATCH OF PACIFIC COD (GADUS MACROCEPHALUS) (MT). TOTAL = 87.

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	
643	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	643
640	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	640
633	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	633
630	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	630
623	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	623
620	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	620
613	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	613
610	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	610
603	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	603
600	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600
593	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	593
590	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	590
583	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	583
580	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580
573	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573
570	*	*	*	*	*	*	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	570
563	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	563
560	*	*	*	*	*	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	560
553	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	553
550	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	14	550
543	*	*	*	*	*	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	543
540	*	*	*	*	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	540
533	*	*	*	*	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	533
530	*	*	*	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	530
523	*	*	0	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	*	*	*	523
	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	

Section - 3

1984 NATICN CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124
ALEUTIAN ISLANDS - CATCH OF PACIFIC COD (GADUS MACROCEPHALUS) (MT). TOTAL = 493.

	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	
553	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	553
550	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	550
543	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	2	0	0	0	*****	*****	543
540	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	540
533	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	*****	*****	533
530	*****	*****	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*****	*****	530
523	*****	*****	0	0	35	0	10	0	0	0	0	0	84	0	0	0	0	0	0	2	101	17	*****	*****	523
520	*****	*****	0	0	1	9	3	0	22	5	0	25	0	0	0	0	0	0	0	0	30	10	*****	*****	520
513	*****	*****	0	0	0	0	0	0	0	55	26	2	0	0	0	0	0	0	0	0	9	0	*****	*****	513
510	*****	*****	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	*****	*****	510
503	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	503
500	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	500
493	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	493
490	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	490
	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	

1985 Foreign Pacific Cod by Trawl Fishery- Section - 1

1985 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 81 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124

EASTERN BERING SEA - CATCH OF PACIFIC COD (GADUS MACROCEPHALUS) (MT). TOTAL = 17463.

	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	
643	0	0	0	0***	***	***	***	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	643
640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	640
633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	633
630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	630
623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	623
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	620
613	0	0	0	8	11	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	***	613
610	0	0	16	170	165	22	12	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	***	610
603	40	280	199	278	330	90	1	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	603
600	29	723	95	276	418	331	14	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	***	***	600
593	0	586	126	166	461	294	177	30	1	0	0	0	0	0	0	0	0	0***	***	***	***	***	***	***	593
590	0	115	155	23	270	170	381	283	18	2	1	0	0	0	0	0	0	0***	***	***	***	***	***	***	590
583	0	25	122	129	172	50	276	399	39	31	55	7	8	115	147	137	15	0	0	0	0	0***	***	***	583
580	0	0	0	0	206	18	132	163	147	7	69	89	133	358	259	53	131	16	9	1	0	0	0***	***	580
573	0	0	0	0	0	7	31	209	14	0	3	9	134	329	218	232	329	188	35	0	24	0	0***	***	573
570	0	0	0	0	0	1	92	19	34	1	20	9	11	164	69	253	621	114	1	0	269	0***	***	***	570
563	0	0	0	0	0	0	47	85	73	55	22	22	4	57	308	392	420	0	0	0	362***	***	***	***	563
560	0	0	0	0	0	0	0	0	79	57	85	135	7	2	52	169	173	0	0	0***	***	***	***	***	560
553	0	0	0	0	0	0	0	0	0	0	1	107	12	4	22	21	2	0	0***	***	***	***	***	***	553
550	0	0	0	0	0	0	0	0	0	0	0	19	32	11	12	0	0	0***	***	***	***	***	***	***	550
543	***	***	***	***	***	***	***	***	***	***	0	1	11	137	742	3***	***	***	***	***	***	***	***	***	543
540	***	***	***	***	***	***	***	***	***	***	0	0	2	0	0***	***	***	***	***	***	***	***	***	***	540
533	***	***	***	***	***	***	***	***	***	***	0	0	1***	***	***	***	***	***	***	***	***	***	***	***	533
530	***	***	***	***	***	***	***	***	***	***	0	0***	***	***	***	***	***	***	***	***	***	***	***	***	530
523	***	***	***	***	***	***	***	***	***	***	0	0***	***	***	***	***	***	***	***	***	***	***	***	***	523
	177	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	

Section - 2

1985 NATION CODES - J1 J2 J3 U1 K1 P1 T1 G1 B1 GEAR CODES 1 2 3 6 0 0 0 0 0 0 SUETO/124

ALEUTIAN ISLANDS - CATCH OF PACIFIC COD (GADUS MACROCEPHALUS) (MT). TOTAL = 9.

	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	
553	*****	*****	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	*****	*****	553
550	*****	*****	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	*****	*****	550
543	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	543
540	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	540
533	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	533
530	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	*****	*****	530
523	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	*****	*****	523
520	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	520
513	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	513
510	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	510
503	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	503
500	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	500
493	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	493
490	*****	*****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*****	*****	490
	268	269	270	271	272	273	274	275	276	277	278	279	179	178	177	176	175	174	173	172	171	170	169	168	

APPENDIX B

Effort (Hauls) by Foreign and Joint Venture Harvesters for All Species By Month (1984-85)

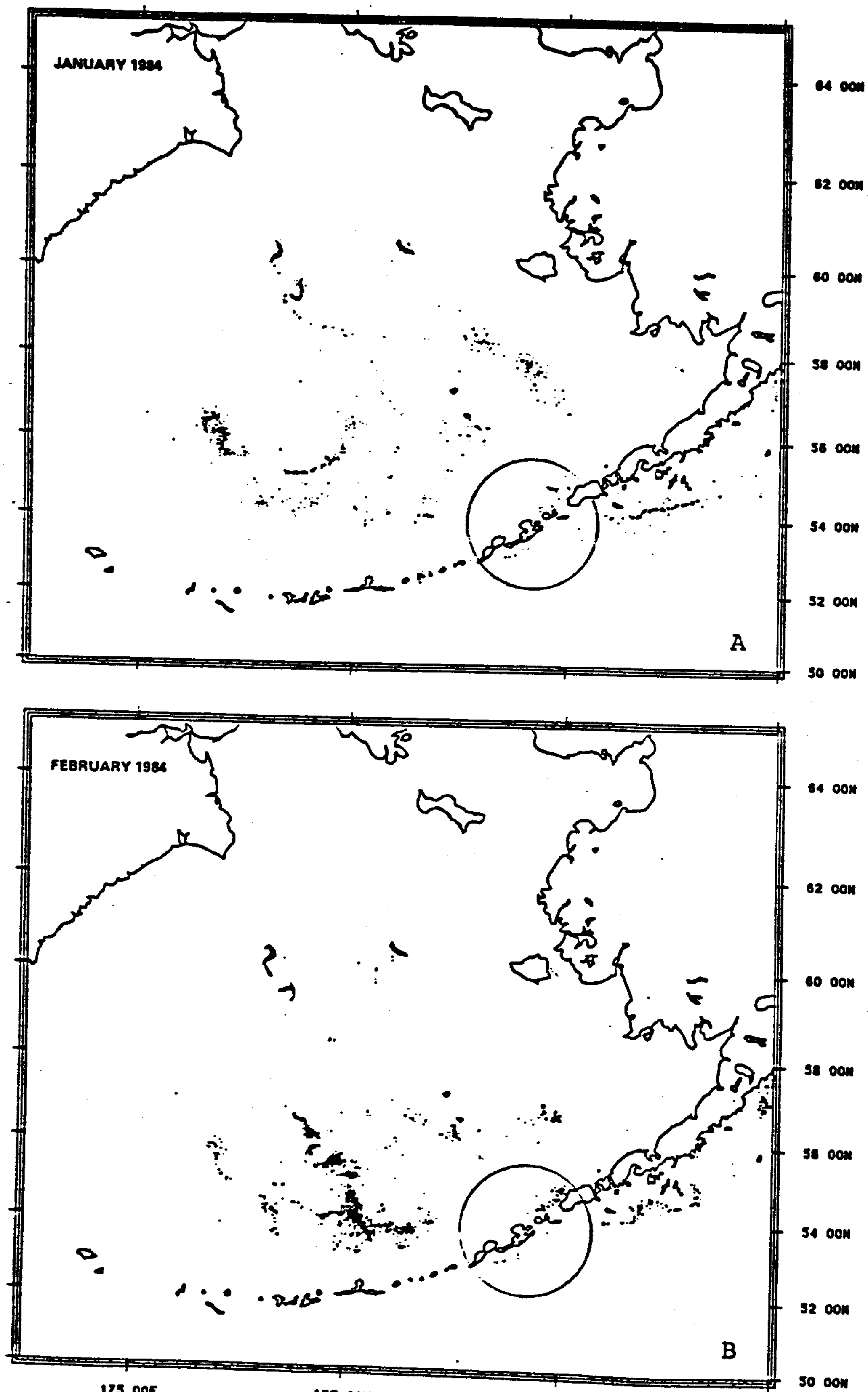


Figure 3.--Total distribution of fishing effort in 1984, by month.

Circle is 100-mile radius from Unalaska

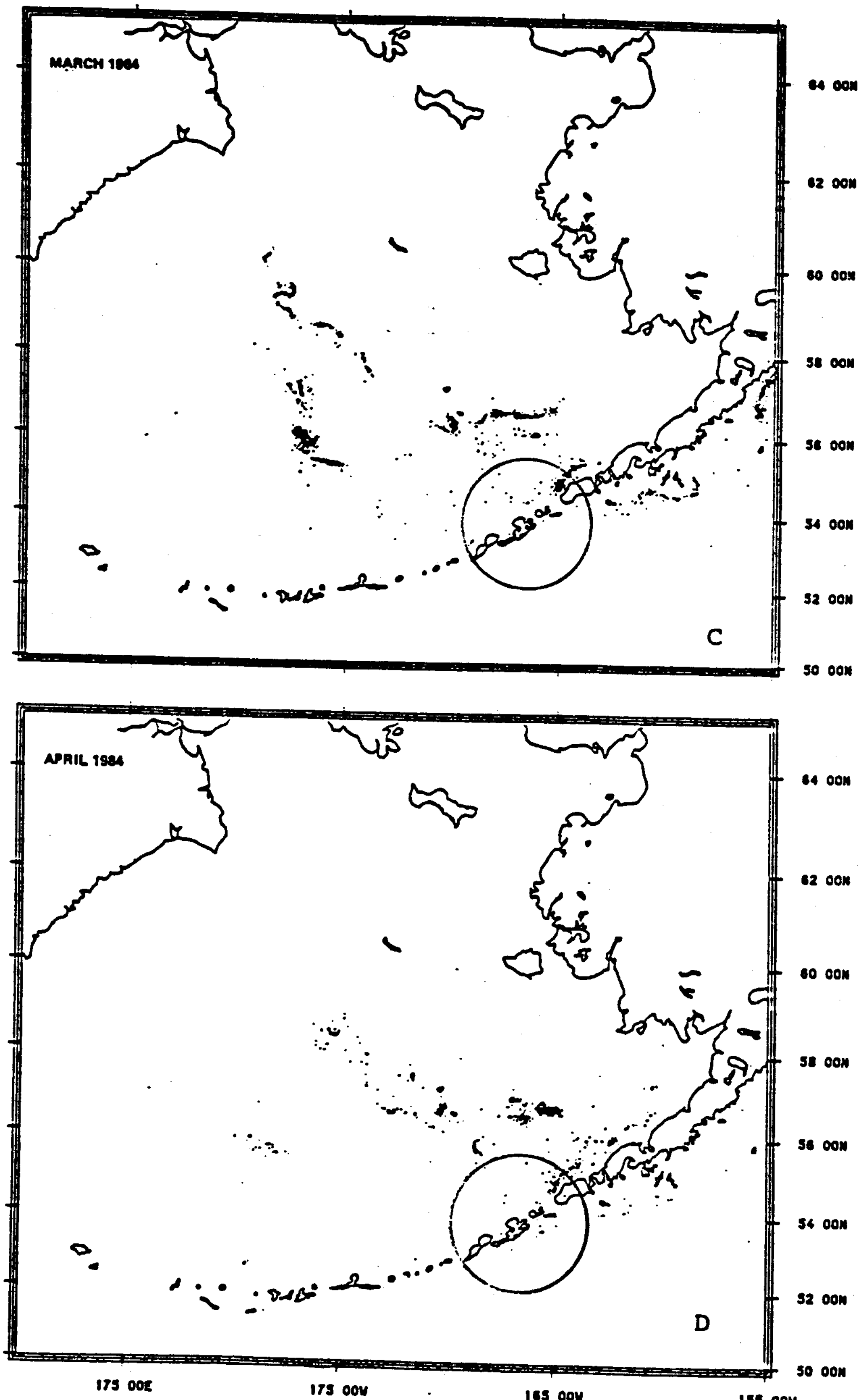


Figure 3(cont.)—Total distribution of fishing effort in 1984, by month.

Circle is 100-mile radius from Unalaska

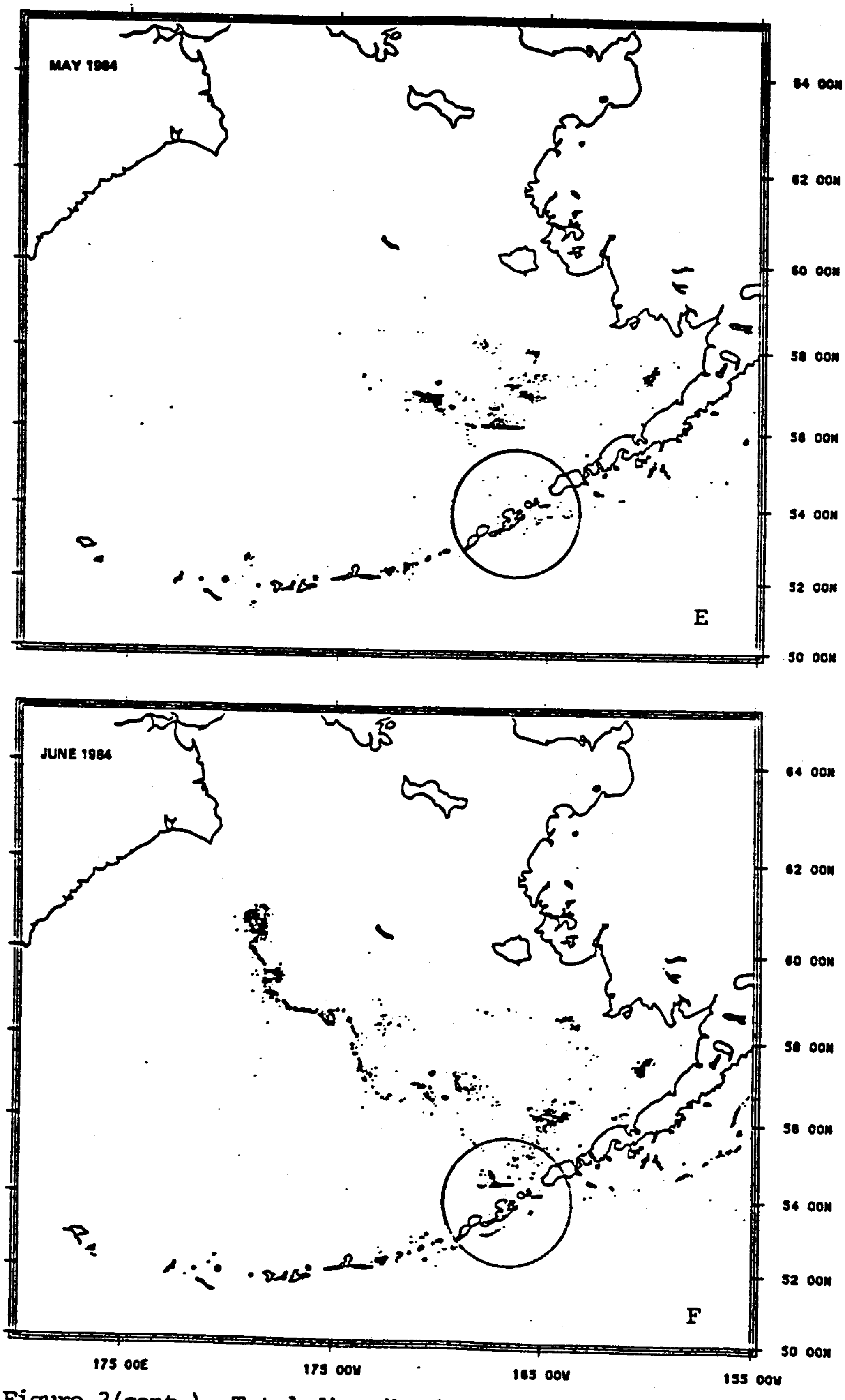


Figure 3(cont.)—Total distribution of fishing effort in 1984, by month.

Circle is 100-mile radius from Unalaska

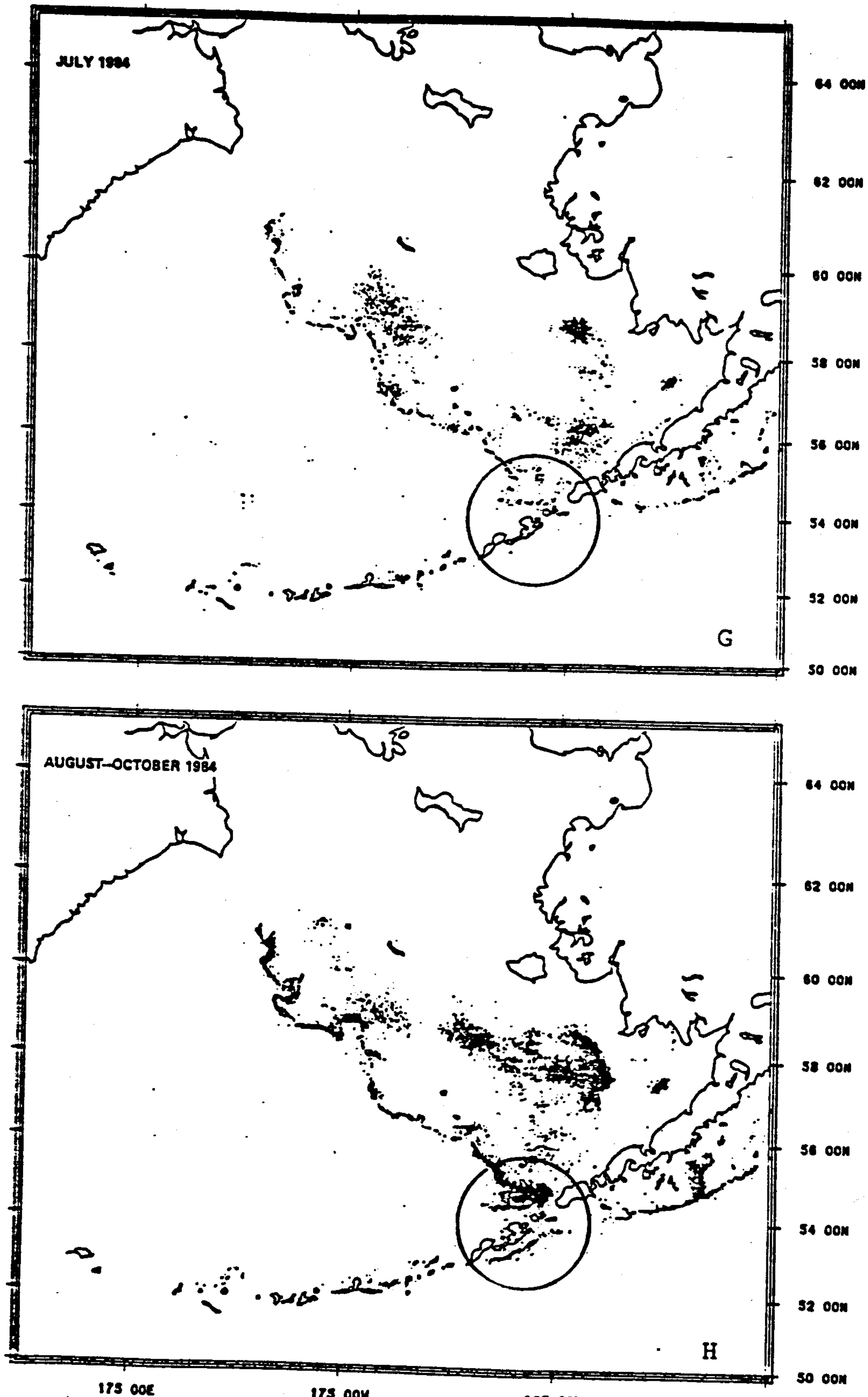
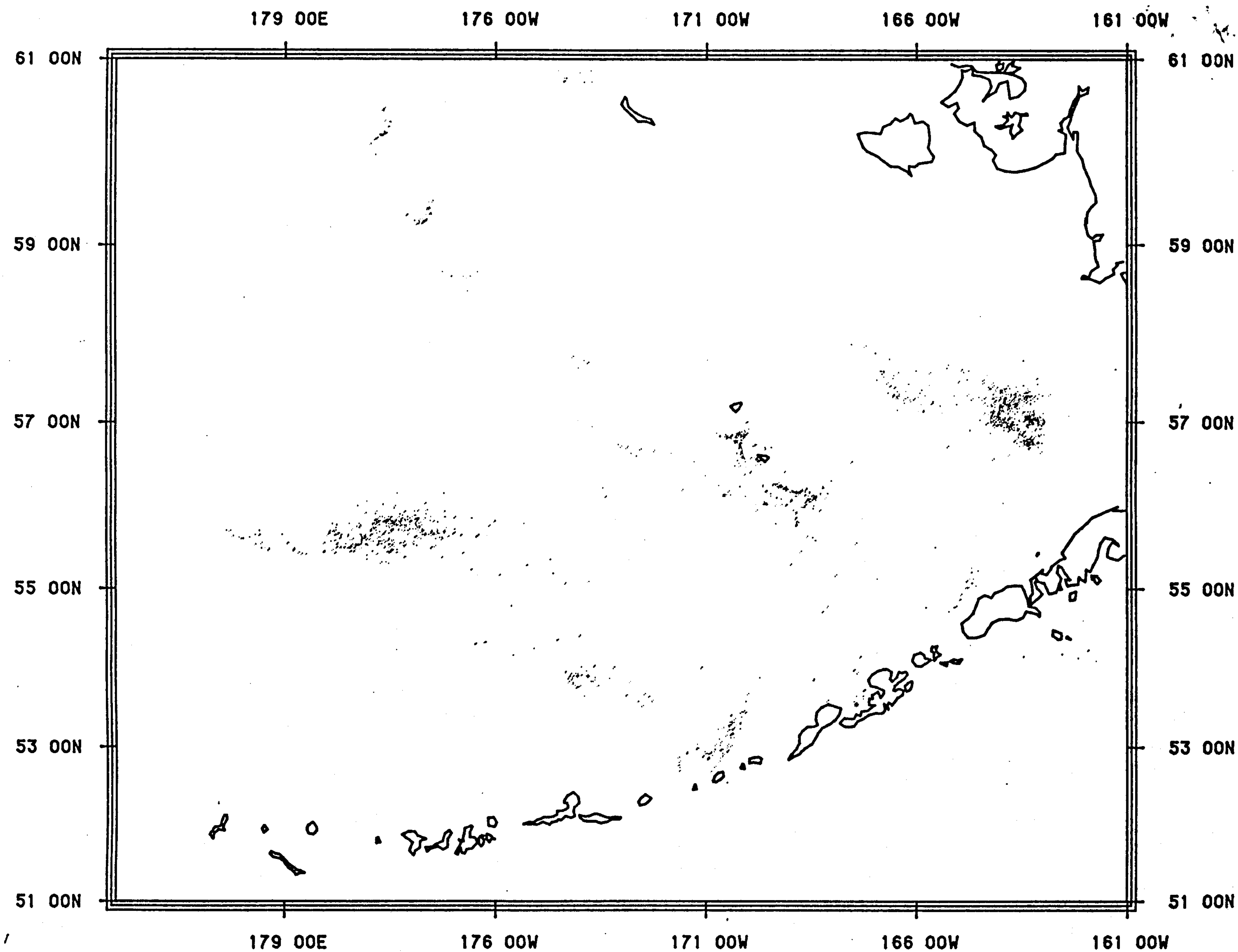
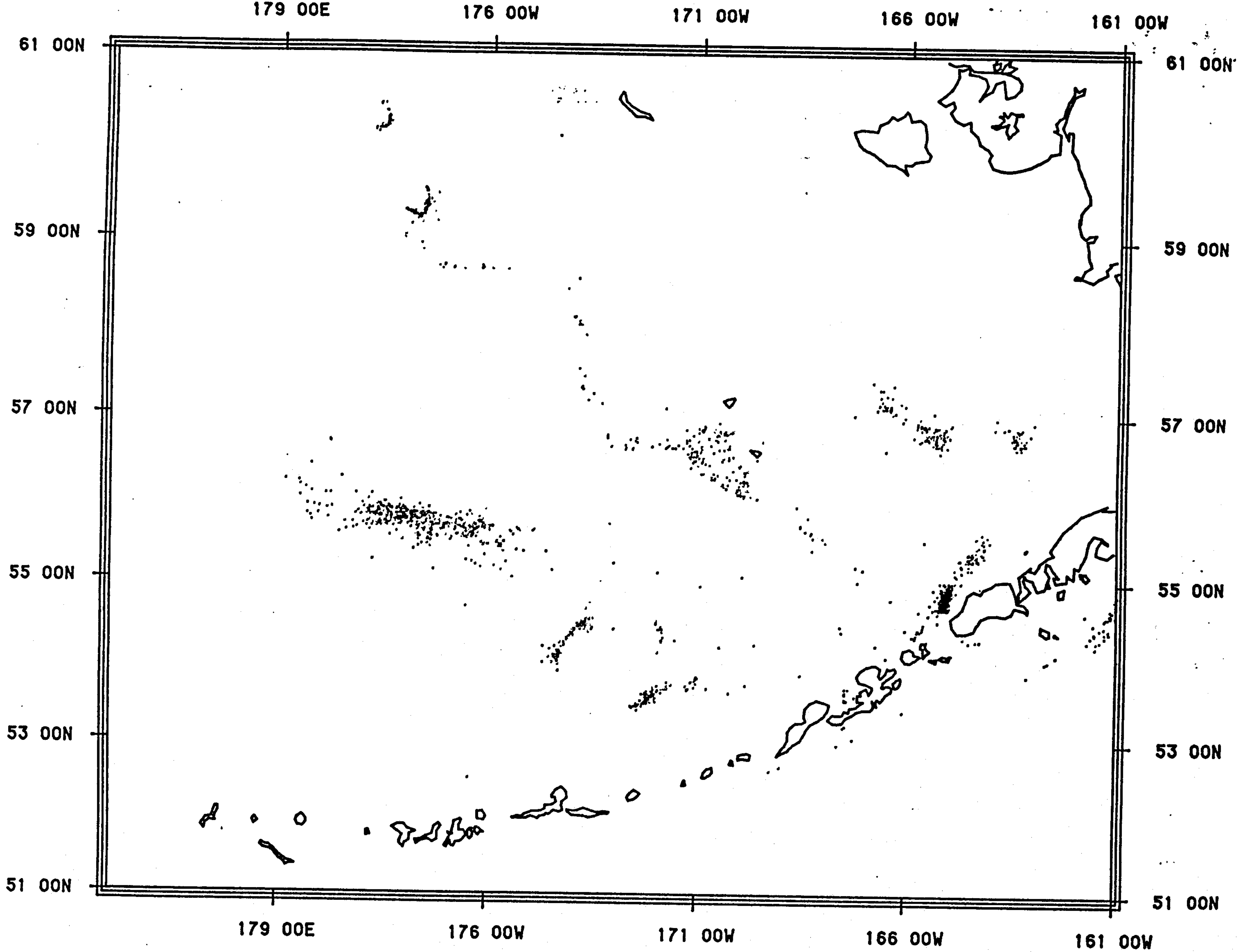


Figure 3(cont.)—Total distribution of fishing effort in 1984, by month.

Circle is 100-mile radius from Unalaska



FOREIGN FISHING EFFORT IN THE BERING SEA - JANUARY, 1985



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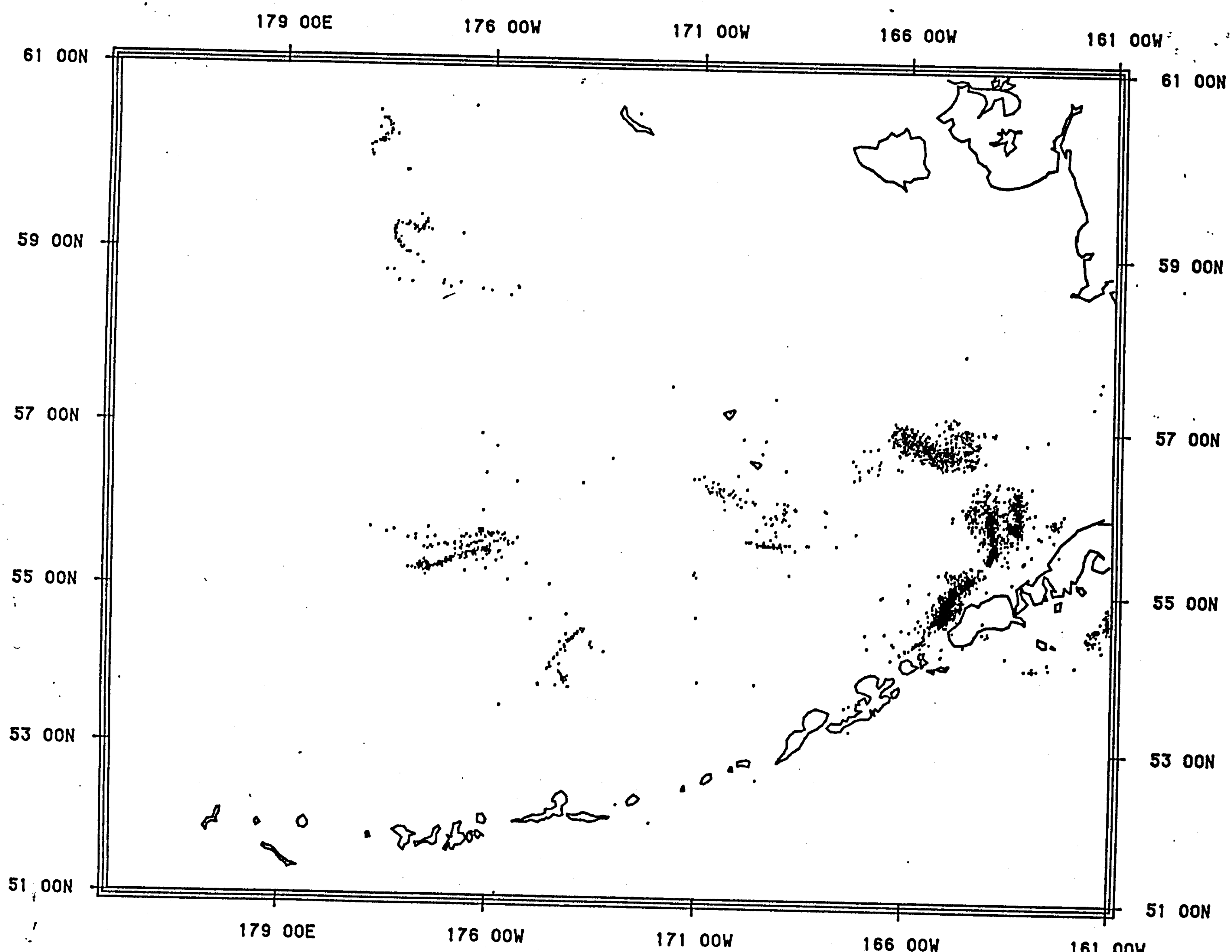

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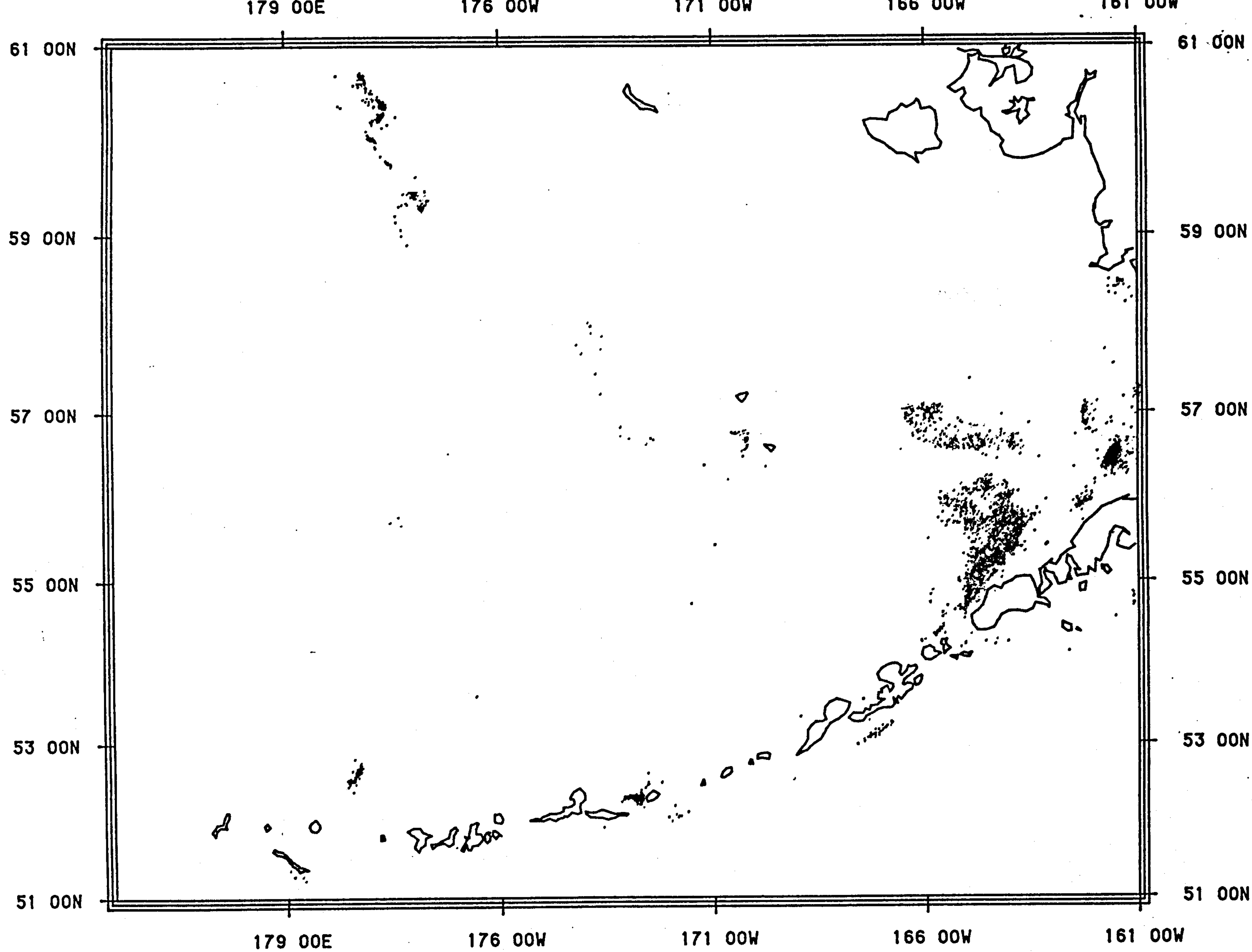

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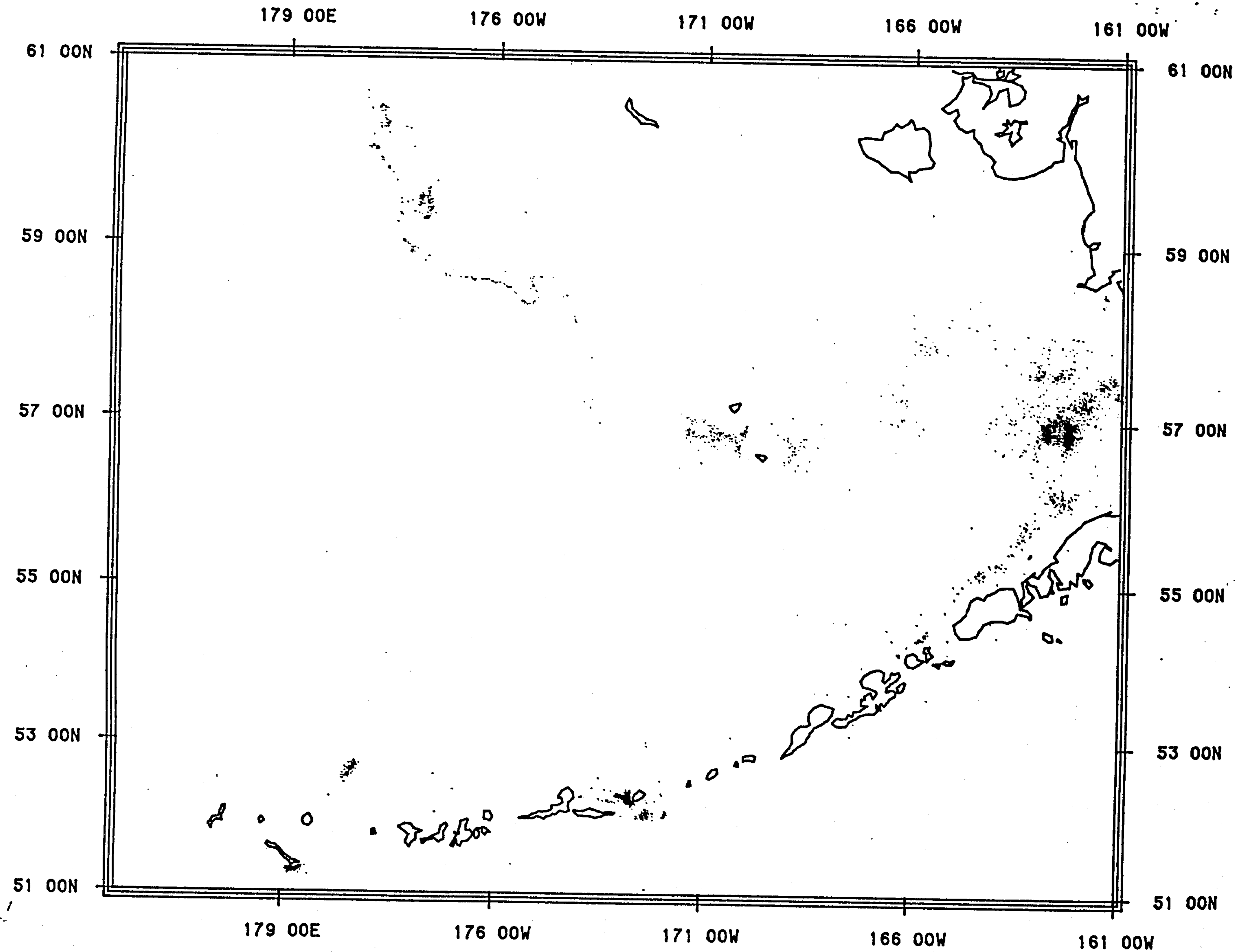
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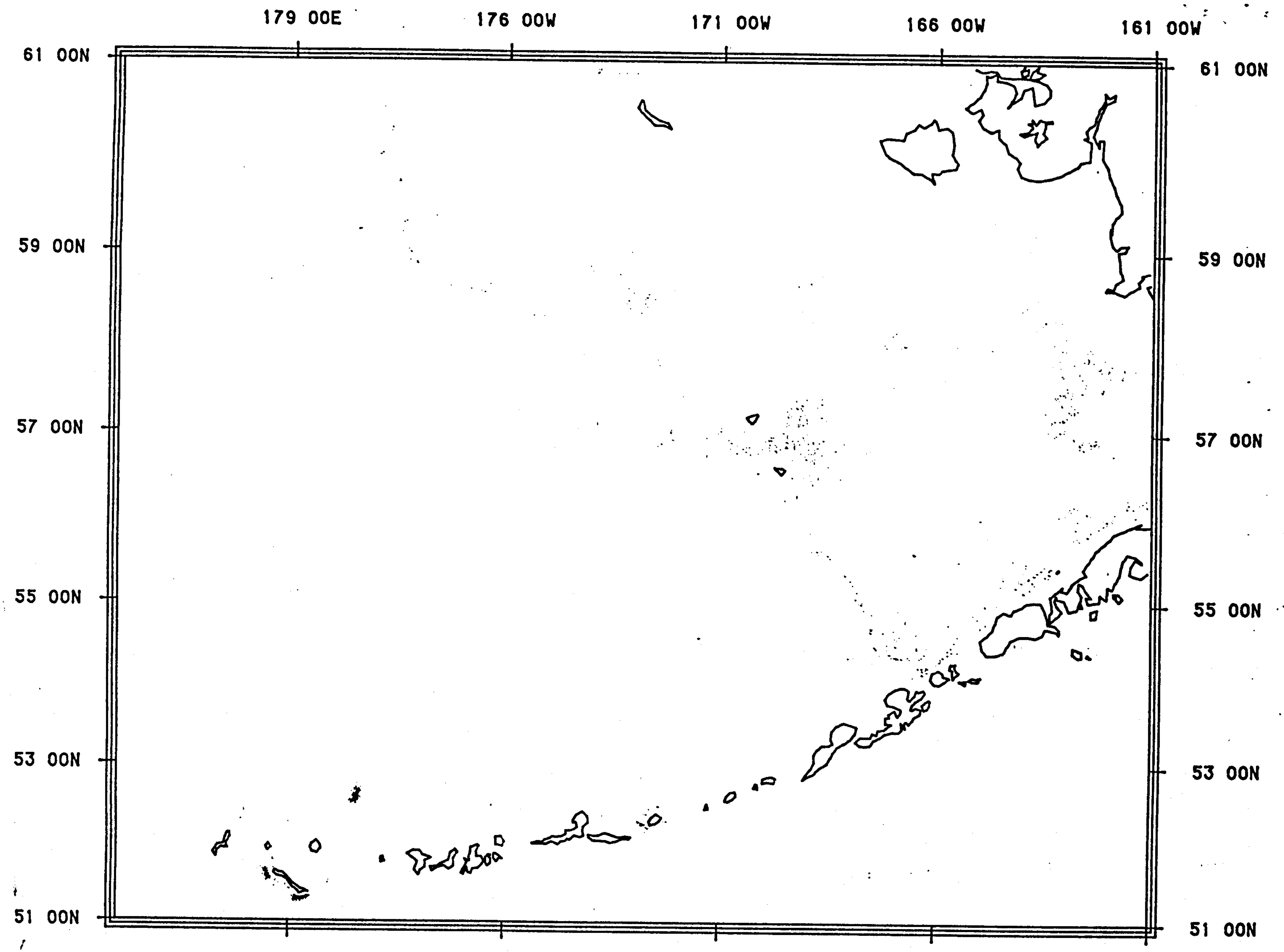

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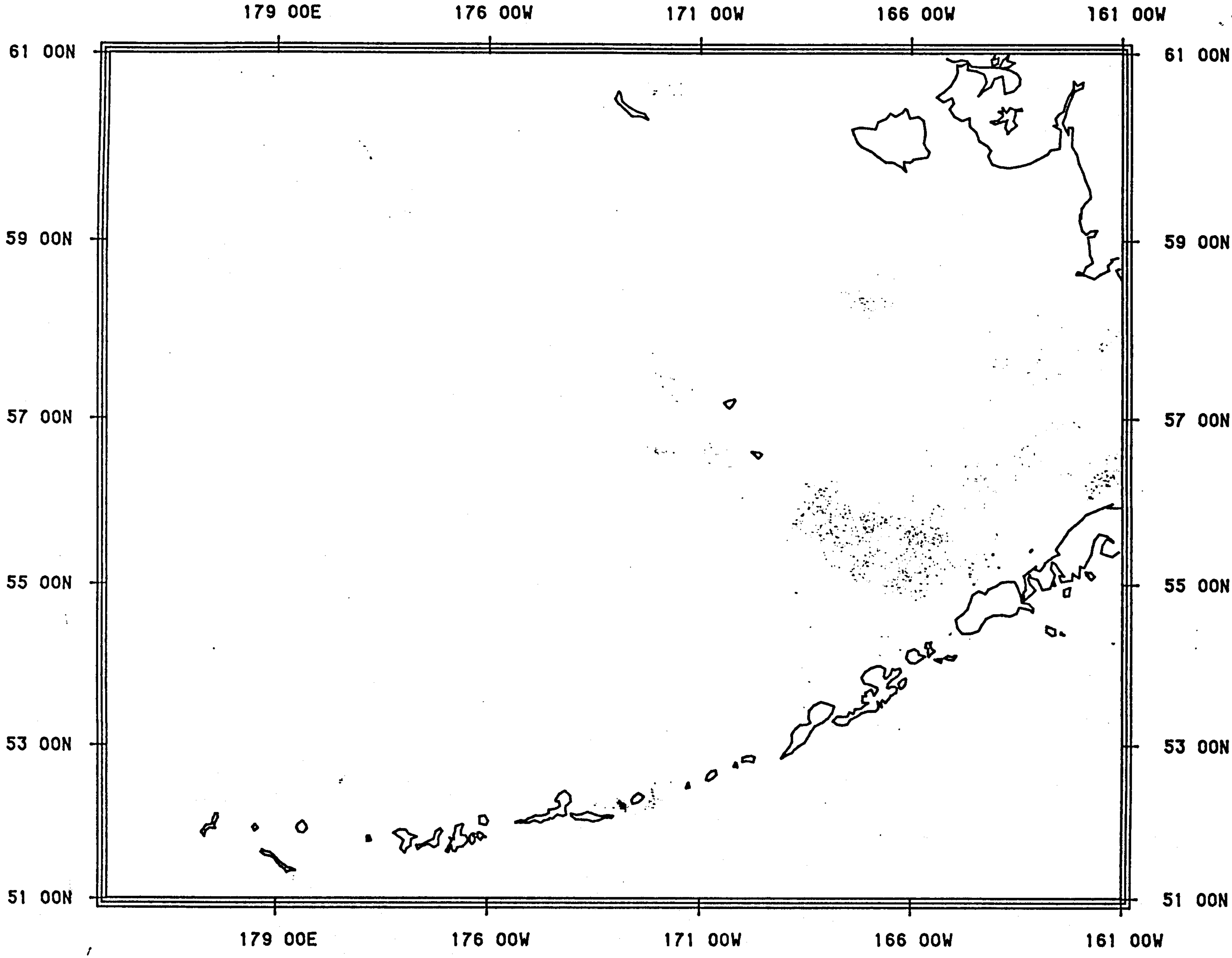

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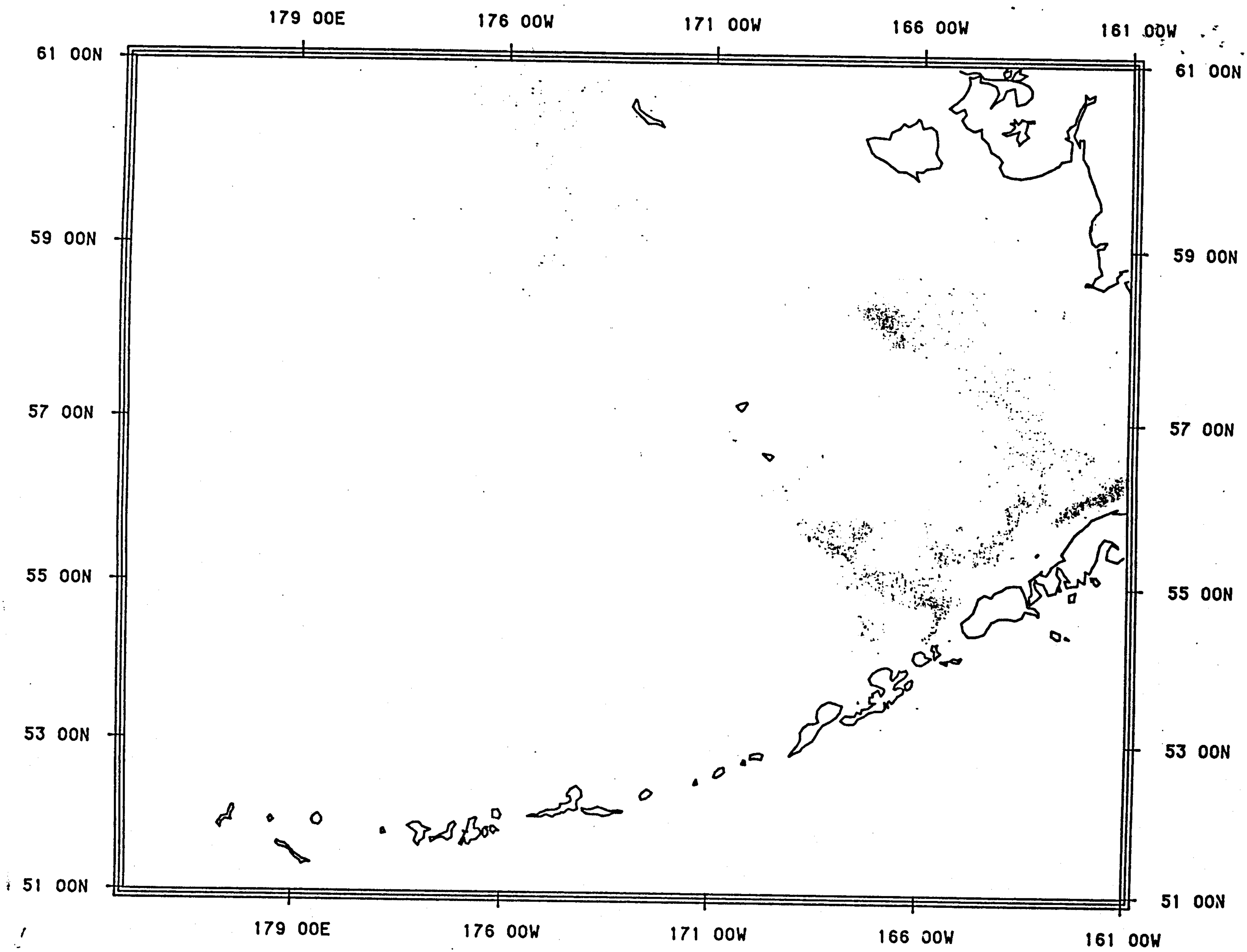

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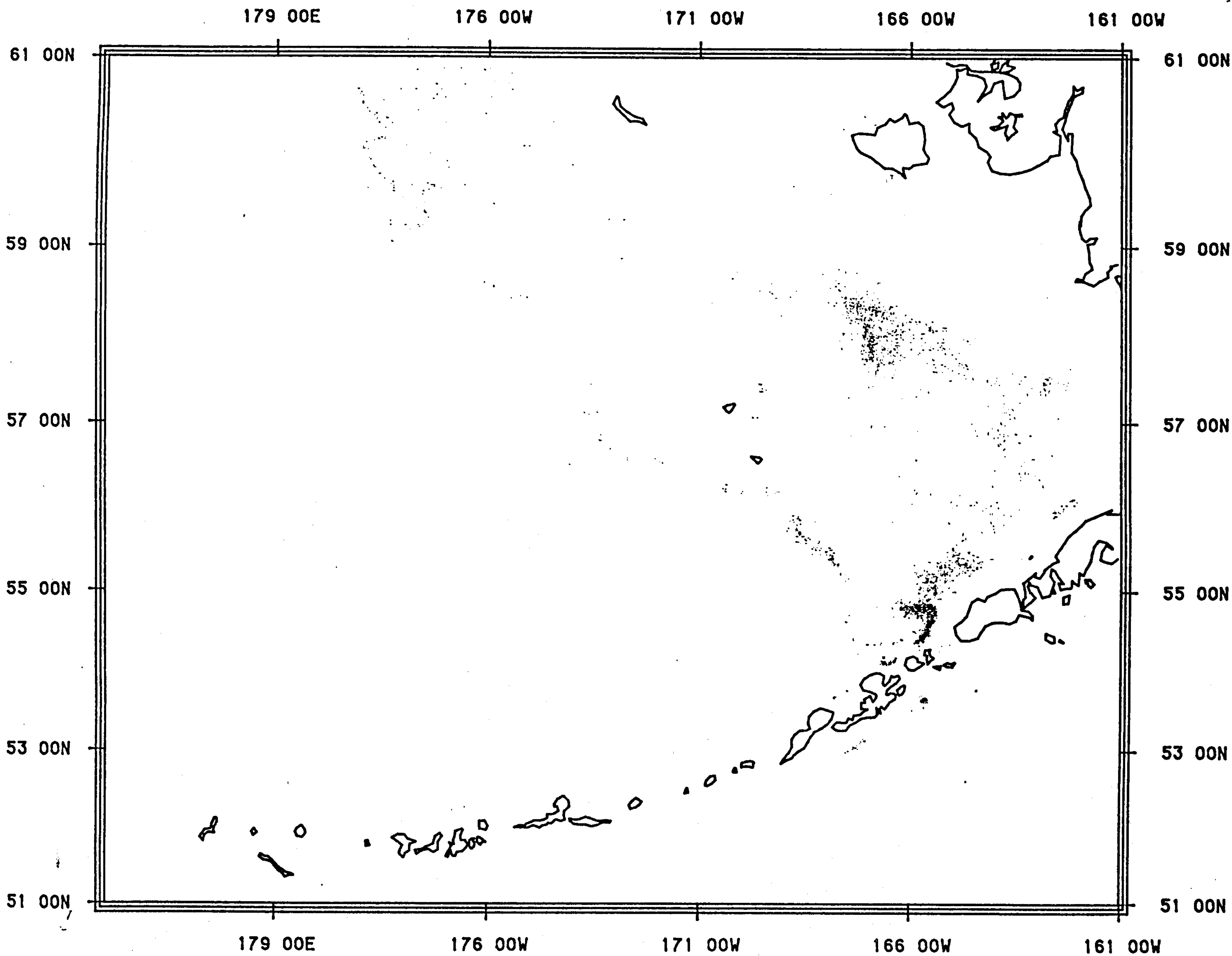
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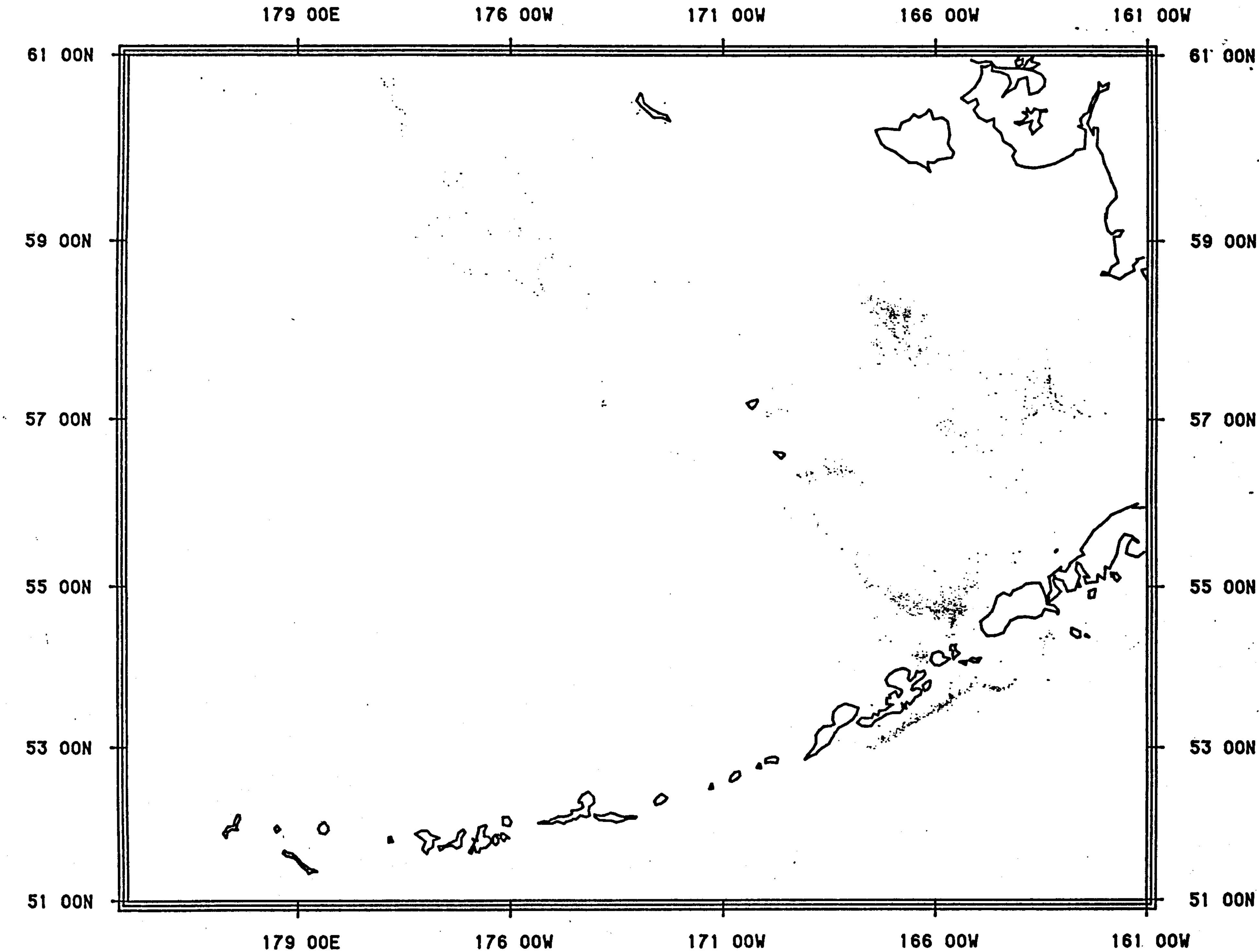

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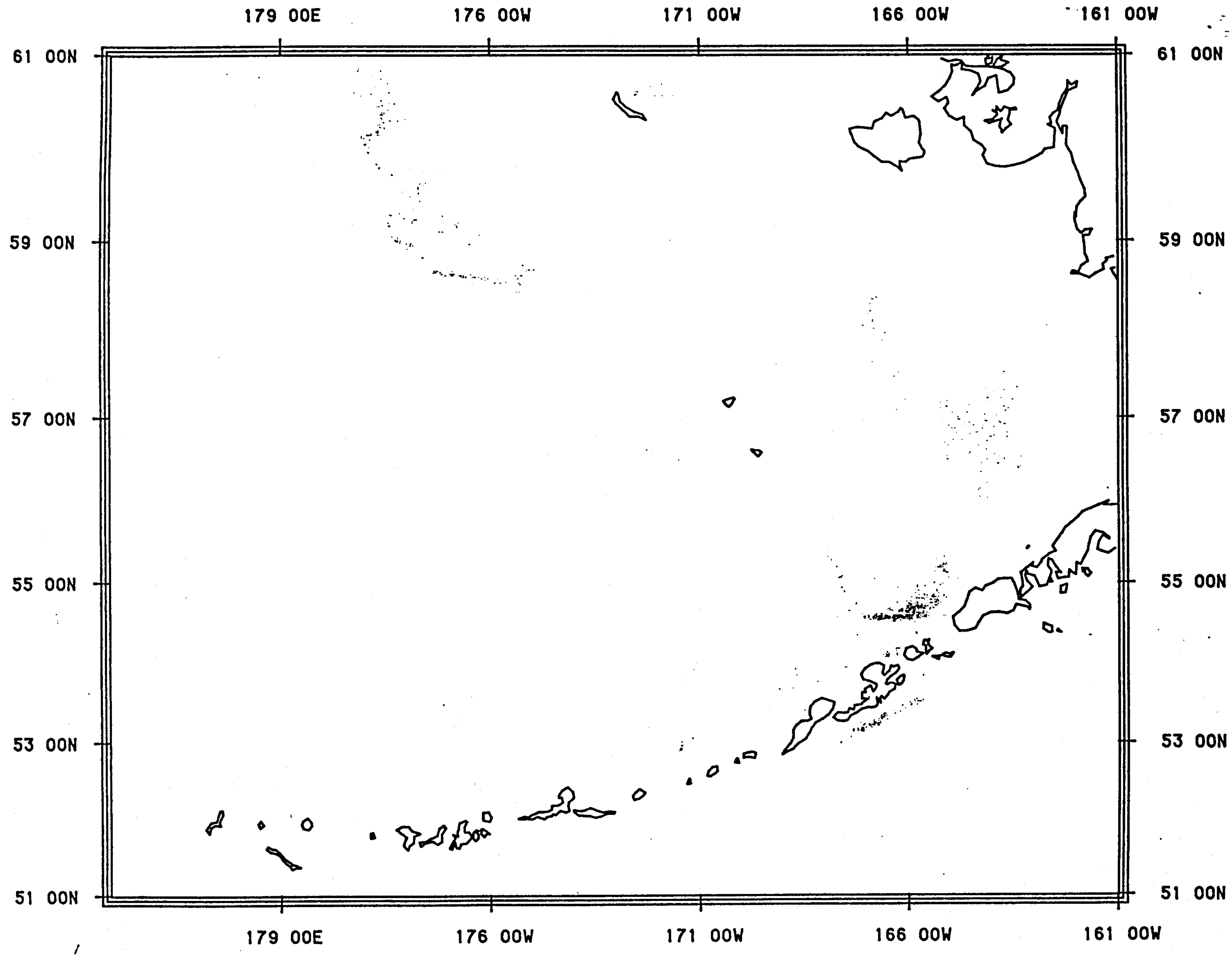

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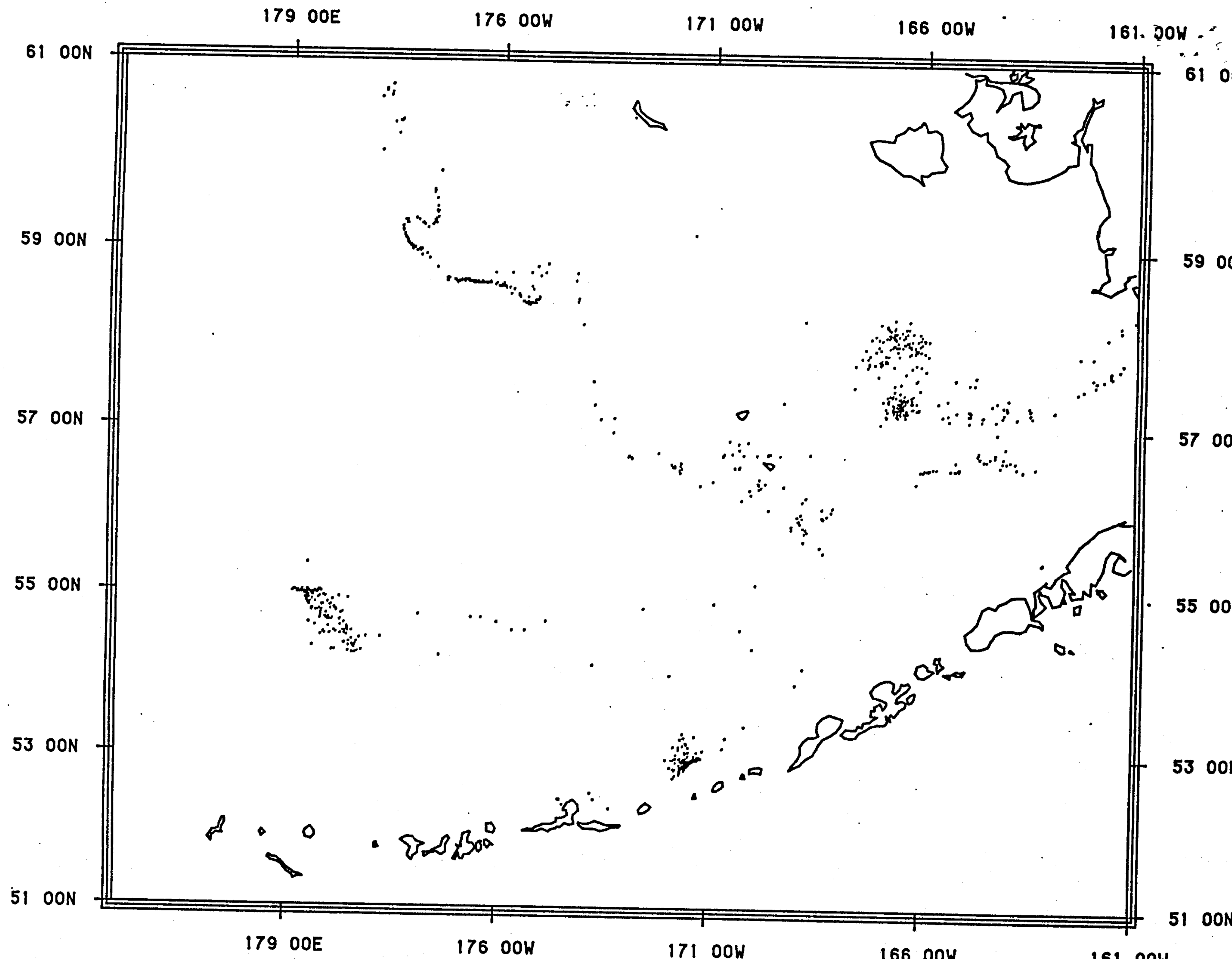


FOREIGN FISHING EFFORT IN THE BERING SEA - DECEMBER, 1985

APPENDIX C

CPUE for Cod (1985-86) and Pollock (1982-86)

from NMFS Summer Survey

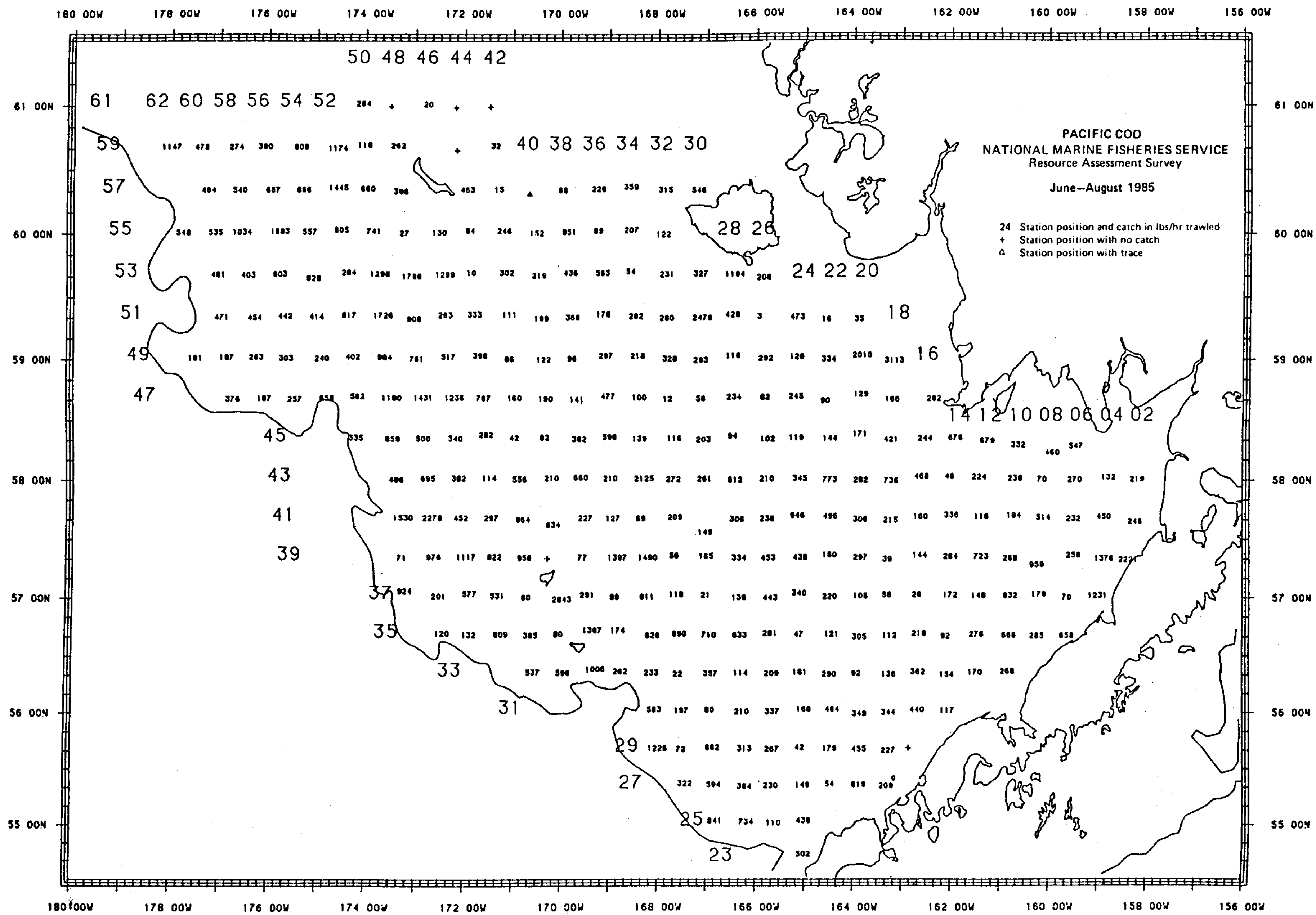


Figure 4.--Catches of Pacific cod (lb/hr) during the 1985 eastern Bering Sea summer groundfish survey.

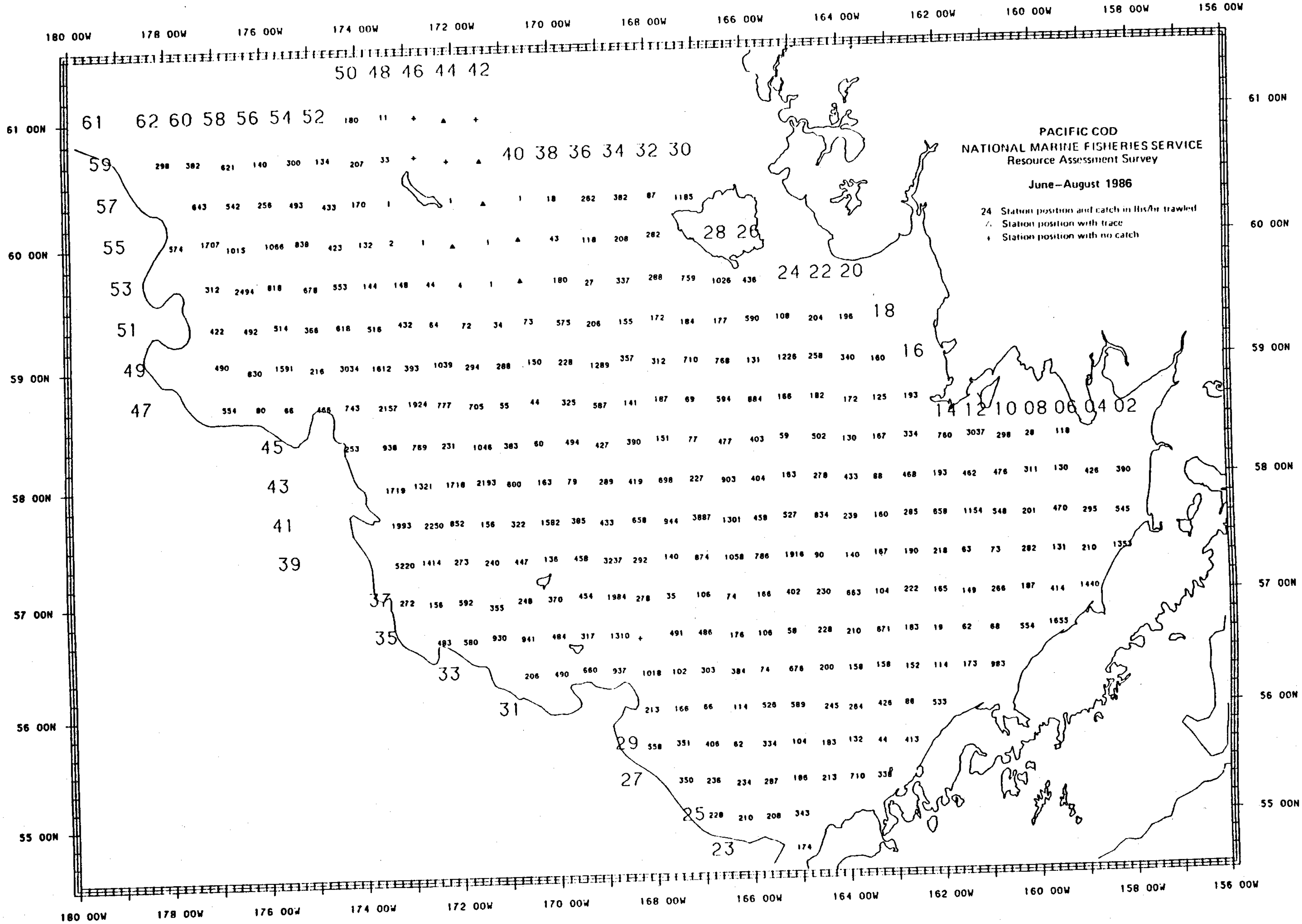


Figure 4.--Catches of Pacific cod (lb/hr) during the 1986 eastern Bering Sea summer groundfish survey.

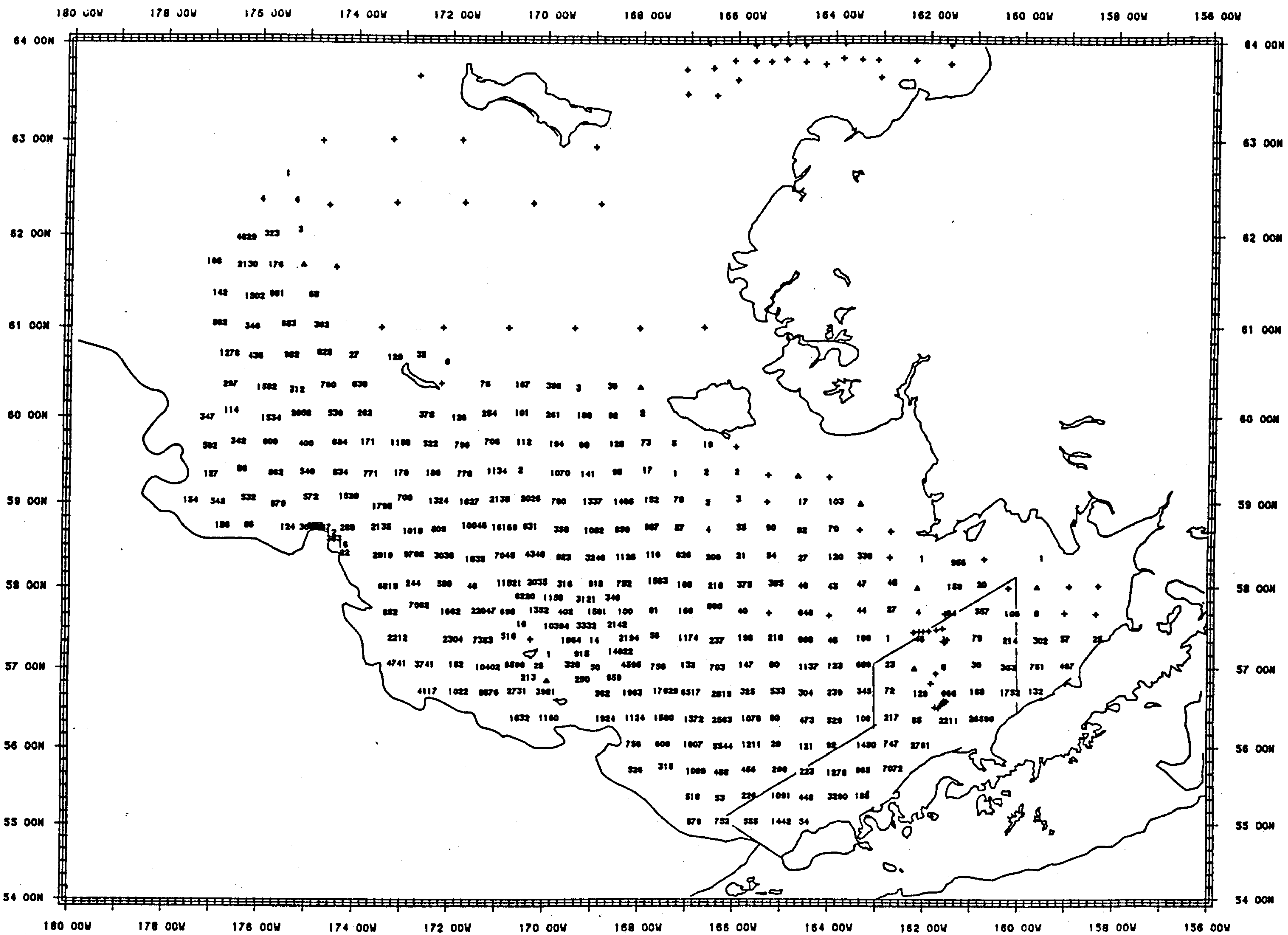
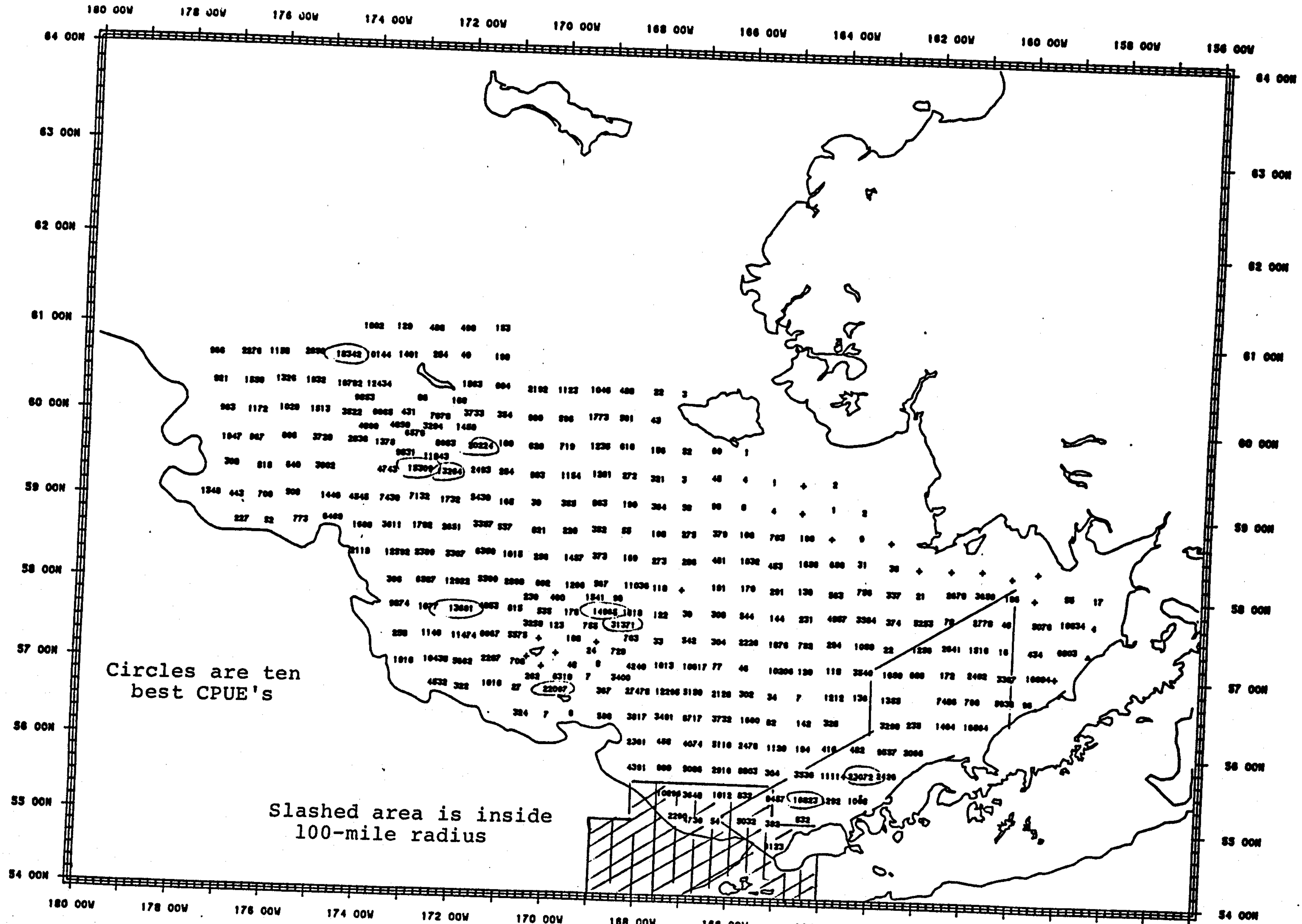
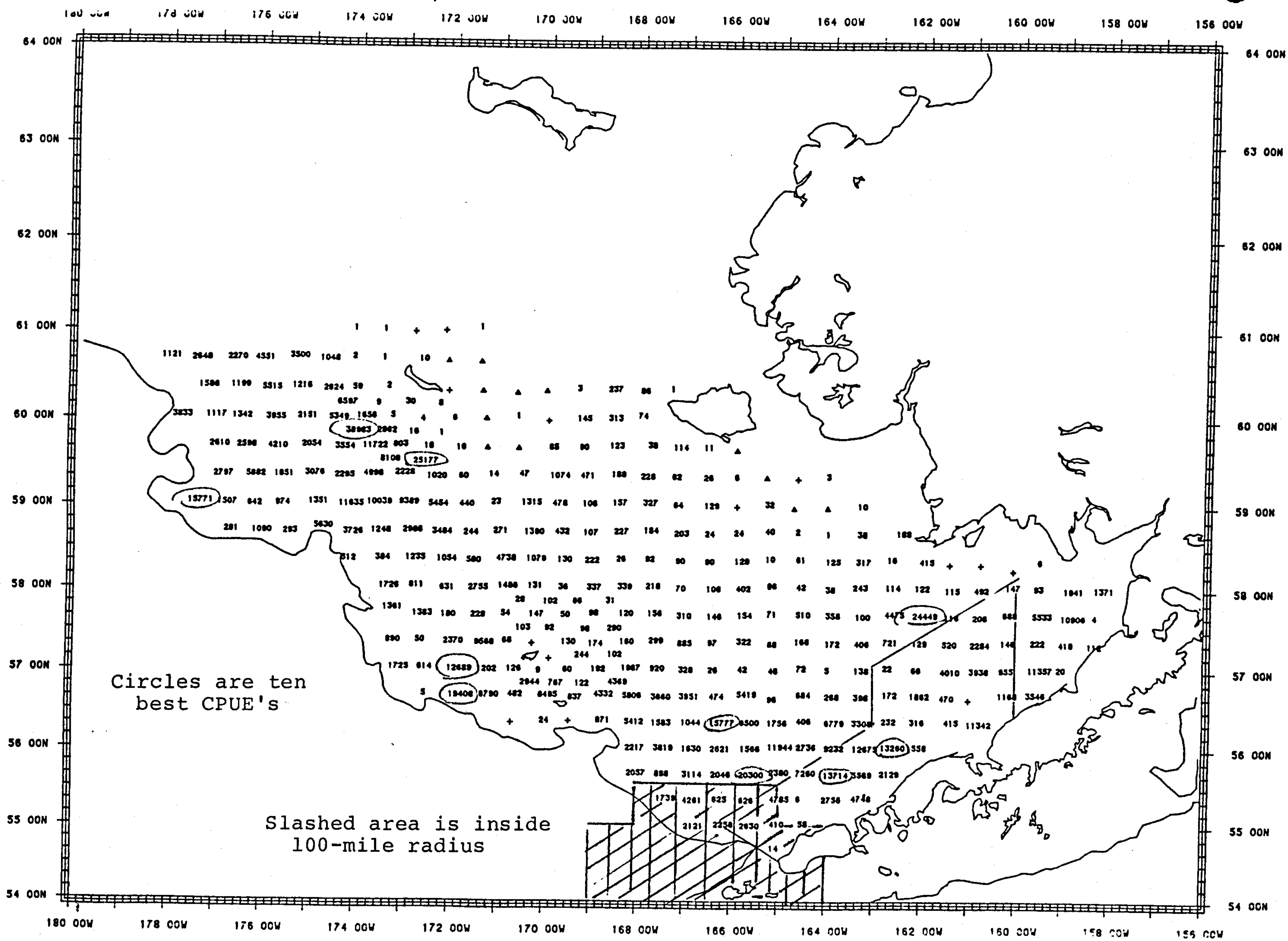


Figure 31.--Catch per unit effort (lbs/hr trawled) of walleye pollock (*Theragra chalcogramma*) from 1982 research survey data.



•--Catch per unit effort (lbs/hr trawled) of walleye pollock (<u>Theragra chalcogramma</u>) from 1983 research survey data.



.--Catch per unit effort (lbs/hr trawled) of walleye pollock (Theragra chalcogramma) from 1984 research survey data.

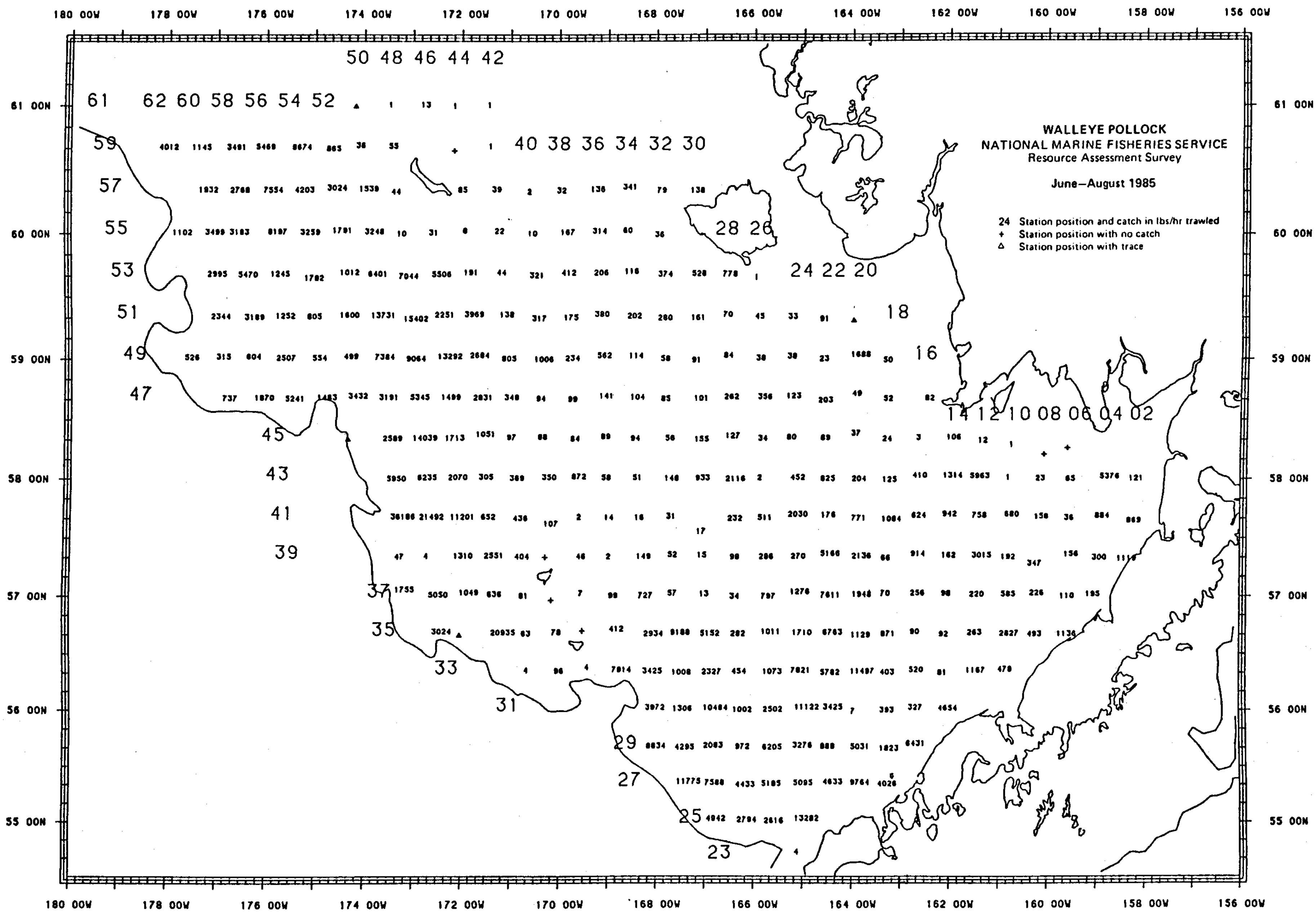


Figure 2.--Catches of walleye pollock (lb/hr) during the 1985 eastern Bering Sea summer groundfish survey.

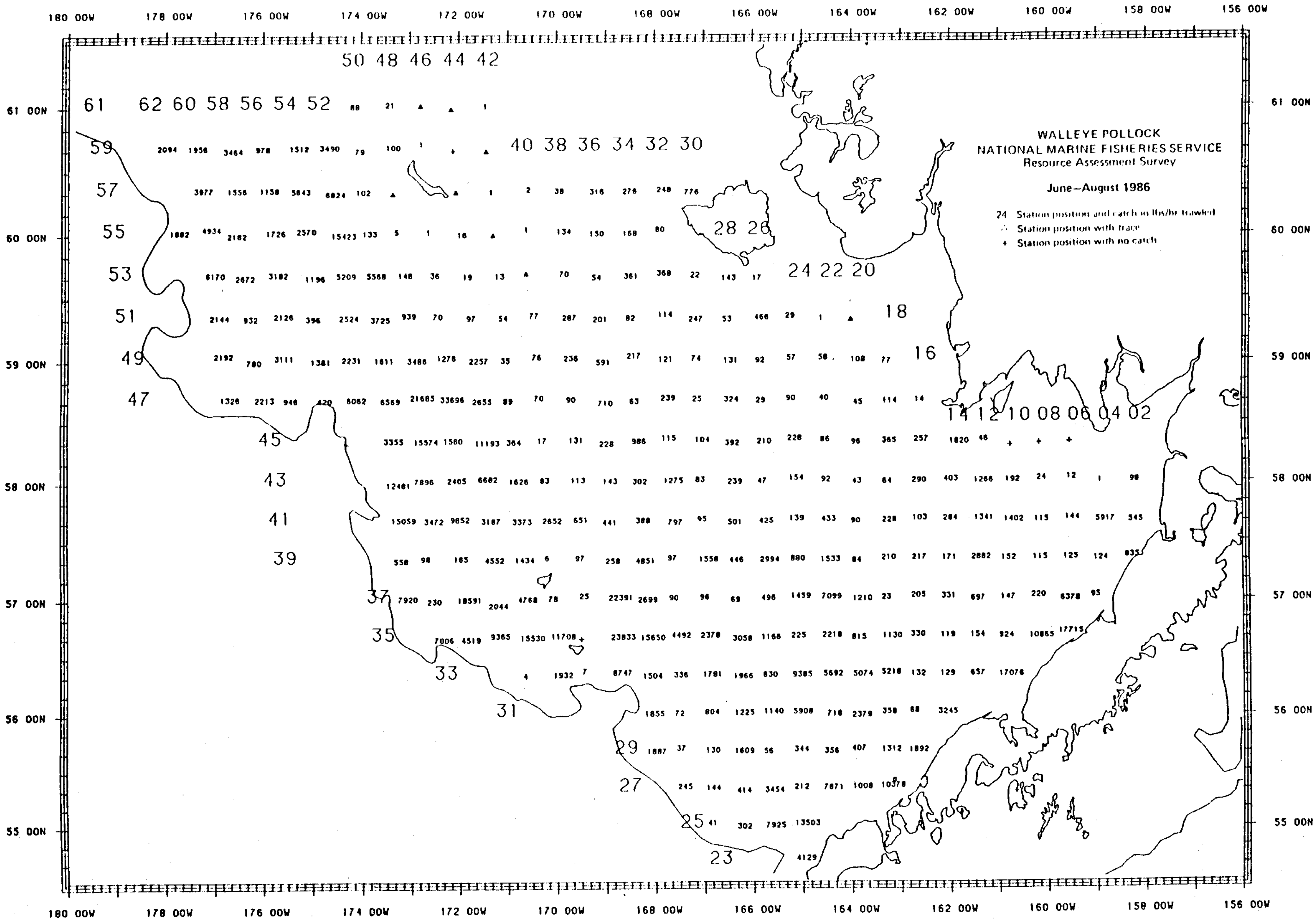


Figure 2.--Catches of walleye pollock (lb/hr) during the 1986 eastern Bering Sea summer groundfish survey.

3.0 REVISE THE DEFINITION OF PROHIBITED SPECIES

3.1 Description of and Need for the Action

Prohibited species currently are defined in Section 14.2 of the Bering Sea/Aleutian Islands Groundfish FMP as one of four categories of species likely to be taken by the groundfish fishery. Prohibited species are discussed also under the respective sections on domestic and foreign management measures (Sections 14.4.2 and 14.5.2).

A basic problem with these definitions is that, for some species to be included in the prohibited species category, they would have to be managed under other FMPs or federal regulations. The prohibited species definition under Section 14.2 specifically exempts species the harvest of which is authorized by other FMPs, PMPs or federal regulations. The original BSAI groundfish FMP anticipated other fishery management plans for king crab, Tanner crab and Pacific herring. However, the anticipated FMPs for king crab, Tanner crab and Pacific herring ultimately failed to be implemented or were subsequently withdrawn. Therefore, there is a question of whether these species are correctly included in the prohibited species listing. The FMP does not attempt to manage fishing for non-groundfish species but does try to limit injury to those species by groundfish fisheries. The problem with the current definition of prohibited species is that it does not clearly state this intent and may provide legally indefensible protection to species thought to be protected as prohibited species.

An example of this problem is king crab. The prohibited species definition under Section 14.2 makes an exception for species "when ... their retention by United States vessels is not prohibited under other FMPs or federal regulations." Section 14.4.2.A reinforces this exception when it states that "United States vessels must minimize their incidental harvest of ... any ... species the fishery for which ... is governed by another FMP...." Presently, there is no operative FMP for king crab or federal regulation prohibiting the retention of king crabs by domestic vessels. Hence, king crab is a species that fits the exception and is not prohibited. By this reading of the definition, all species listed in the definition are not prohibited except for salmonids and Pacific halibut for which there are other FMPs or federal regulations. This interpretation, however, probably is fallacious since there are other parts of the FMP that indicate prohibited status for non-groundfish species. The current prohibited species definition is at fault for not clearly stating this intent.

In summary, the FMP has a flawed definition of prohibited species. As a result, regulations implementing the FMP pertaining to prohibited species suffer from confusing and imprecise language that may not be legally enforceable against all vessels fishing for groundfish in the EEZ off Alaska. This is especially true for Tanner and king crab and Pacific herring since anticipated FMPs for these species are not now in effect. This problem extends also to other non-groundfish species for which other applicable law does not exist.

3.2 The Alternatives

3.2.1 Alternative 1: Do nothing (the status quo).

Under this alternative, no changes would be made to the definition of prohibited species in the FMP or its implementing regulations.

3.2.2 Alternative 2: Revise definition of prohibited species.

Under this alternative, the prohibited species definition in the FMP would be changed to list those species or species groups which must be avoided while fishing for groundfish and, if caught incidentally, must be immediately returned to the sea with minimum injury. Listed species will include the "traditional" species of salmon, halibut, herring, king and Tanner crabs for domestic and foreign groundfish fisheries plus other non-groundfish species for the foreign fishery only. Retention of any of these species would not be allowed unless authorized by other applicable law. This would allow, for example, a groundfish fishermen the option of retaining halibut caught with hook and line gear during an open season for halibut specified by the International Pacific Halibut Commission. In addition, the definitions would provide for treating groundfish for which the TAC has been fully harvested in the same manner as prohibited species. Changes appropriately reflecting these new definitions would be made in the regulations implementing the FMP. Specific FMP and regulatory language for this alternative is given under Sections 3.5 and 3.6 of this chapter.

3.3 Biological and Physical Impacts

Pacific halibut, Pacific herring, salmon, king and Tanner crabs are often referred to as the "traditional" prohibited species because of preexisting state restrictions on taking these species outside of bona fide fisheries for them. In addition, traditional fisheries off Alaska have largely targeted these species. The FMP is intended to protect these traditional fisheries while fostering the growth of the domestic groundfish fishery. Hence, there is a common understanding of what species are prohibited and must not be retained if caught while fishing for groundfish.

Neither alternative would change this common understanding of prohibited species. Therefore, there are no biological and physical impacts expected under either alternative. No substantive change is expected in the behavior of the groundfish fishery under either alternative. The amount and kind of fishing mortality imposed on groundfish and non-groundfish species will likely remain unchanged. Likewise, no significant change in the perturbations on the physical environment from fishing activity is expected under either alternative.

To the extent that enforcement of prohibited species restrictions is enhanced under Alternative 2, however, domestic groundfish fishermen may improve their ability to avoid catches of prohibited species. As such, Alternative 2 may provide for a marginal decrease in the mortality rate of prohibited species. In addition, there may be an associated decreased perturbation of the physical environment important to prohibited species due to decreased activity of fishing gear in areas of prohibited species abundance. The extent to which these improvements in the environment of prohibited species may occur is speculative at best and impossible to measure against the normal variability of factors affecting marine life.

3.4 Socioeconomic Impacts

Because Alternative 2, as compared to the status quo, would not significantly affect the common understanding of prohibited species, no significant change in the behavior of groundfish fishermen is expected under Alternative 2. Hence, this alternative would not significantly affect the amount of groundfish harvested, the location or timing of the fishery, nor the choice of fishing gear used. Instead, the intended and expected effect is an improvement in the ability to enforce the Council's existing and basic policy on prohibited species. Any economic impacts on the groundfish fishery from implementation of Alternative 2, therefore, would stem from an increased probability of imposing penalties for violating prohibited species regulations.

Assuming that levying penalties for violating prohibited species regulations has the effect of increasing conformance within the groundfish fishery, economic benefits under Alternative 2 would accrue to the legitimate users of the prohibited species, i.e., the salmon, herring, halibut and crab fisheries, since more of these species would remain unmolested by the groundfish fishery. Whether implementation of Alternative 2 would cause any real increases in catches in the salmon, herring, halibut and crab fisheries is debatable and would depend on a substantial decrease in the actual number of prohibited species intercepted by the groundfish fishery. Calculating these benefits would require information on the number, size, and species of prohibited species that would not be intercepted due to the threat of punitive legal action under Alternative 2 and the assumption that those species not intercepted would ultimately be caught by legal fisheries. Such information is not available.

Another potential benefit from implementing Alternative 2 is the increased potential of successfully prosecuting groundfish fishermen who violate prohibited species regulations. This benefit cannot be characterized in monetary terms unless the information described above is available and the attendant assumptions are correct. Otherwise, this benefit may be viewed more as a cost to society in terms of increased litigation and a cost to fishermen violators who otherwise (under the status quo) would have been treated with impunity.

In summary, marginal economic benefits of Alternative 2 in terms of decreased interceptions of prohibited species by the groundfish fishery cannot be quantitatively estimated. The principle benefit of Alternative 2, however, is the improved ability to enforce the prohibited species regulations against all vessels fishing for groundfish in the EEZ off Alaska. If it is assumed that this improved enforcement capability will result in increased conformance within the groundfish fleet, then the added administrative costs of prosecuting prohibited species violations probably are outweighed by the the assumed benefit of increased avoidance of prohibited species by the groundfish fishery.

3.5 FMP Amendment Language

3.5.1 Alternative 1: Do nothing (the status quo).

Text of the FMP regarding prohibited species would remain unchanged at Sections 14.2.B, 14.4.2.A-E, and 14.5.2.A-I. Also, Annex V to the FMP would remain unchanged.

3.5.2 Alternative 2: Revise definition of prohibited species.

Text in the FMP beginning after the first paragraph of Section 14.2.B would be revised to read as follows:

> "Categories of species involved:
>
> Four categories of species or species groups are likely to be taken by the groundfish fishery. The optimum yield concept is applied to all except the 'prohibited species' category. These categories are tabulated in Annex V and are described as follows:
>
> > 1. Prohibited Species -- those species and species groups the catching of which must be avoided while fishing for groundfish and which must be immediately returned to the sea with a minimum of injury when caught and brought aboard, except when their retention is authorized by other applicable law."

Other text in the FMP would be revised to read as follows at the indicated sections:

> "14.4.2.A. General. Pacific halibut, Pacific herring, salmon, Tanner crab, and king crab are prohibited species when fishing for groundfish and must be treated in accordance with Section 14.2.B.1. Groundfish species or species groups under this FMP for which the TAC has been achieved shall be treated in the same manner as prohibited species.
>
> 14.4.2.B. Objective. The objective of this section is to provide an environment which supports domestic harvesting of groundfish with an awareness of principles and techniques for keeping incidental catches of Pacific halibut, Pacific herring, salmon, Tanner crab, and king crab to a minimum.
>
> 14.5.2.A. General. The prohibited species and species groups listed in Annex V must be treated in accordance with Section 14.2.B.1. Groundfish species or species groups under this FMP for which the TAC has been achieved shall be treated in the same manner as prohibited species."

Annex V would be changed by adding, in the column headed Prohibited Species", the subheadings "U.S. Vessels" and "Foreign Vessels". The species listed under the "U.S. Vessels" subheading would include "Salmon, Pacific halibut, Pacific herring, King crab, and Tanner crab." The species listed under the "Foreign Vessel" subheading would be the same as those currently listed. In addition, footnote 1 in Annex V would be revised to read as follows: "Must be treated in accordance with Section 14.2.B.1."

3.6 Regulatory Language

3.6.1 Alternative 1: Do nothing (the status quo).

No change would be made to sections pertaining to prohibited species in 50 CFR Parts 611 and 675.

3.6.2 Alternative 2: Revise definition of prohibited species.

In the Foreign Regulations:

Text in §611.93(b)(1)(ii)(A), would be revised to read as follows:

> "The term 'prohibited species' means for purposes of this section: shrimps (*Pandalidae*); scallops (*Pectinidae*); snails (*Gastropoda*); Pacific herring (*Clupea harengus pallasi*); salmonids (*Salmonidae*); Pacific halibut (*Hippoglossus stenolepis*); king crab (*Paralithodes sp.* and *Lithodes sp.*); Tanner crab (*Chionoecetes sp.*); Dungeness crab (*Cancer magister*); corals (*Coelenterata*); surf clam (*Spisula polynyma*); horsehair crab (*Erimacrus isenbeckii*); and lyre crab (*Hyas lyratus sp.*). Except to the extent that their harvest is authorized under other applicable law, the catch or receipt of these species must be minimized and, if caught or received, they must be returned to the sea immediately in accordance with §611.11 of this part. Records must be maintained as required by these §§611.9, 611.90(e)(2), and 611.93 of this part."

In §611.93, Table 1, the column heading "Unallocated Species" would be changed to "Prohibited Species".

In the Domestic Regulations:

In §675.3, paragraph (a) would be revised to read as follows:

> "Federal law. For regulations governing foreign fishing for groundfish in the Bering Sea, see 50 CFR 611.93; for those governing foreign fishing for groundfish in the Gulf of Alaska, see 50 CFR 611.92. For regulations governing fishing by vessels of the United States for groundfish in the Gulf of Alaska, see 50 CFR Part 672; for those governing salmon fishing off Alaska, see 50 CFR Part 674; for those governing permits and certificates of inclusion for the taking of marine mammals, see 50 CFR 216.24. For regulations governing fishing by vessels of the United States for halibut, see the regulations of the International Pacific Halibut Commission at 50 CFR Part 301."

In §675.20(c)(1), the prohibited species definition would be revised to read as follows:

> "Prohibited species, for the purpose of this Part, means any of the species of salmon (*Oncorhynchus sp.*), Pacific halibut (*Hippoglossus stenolepis*), Pacific herring (*Clupea harengus pallasi*); king crab (*Paralithodes camtschatica*, *P. platypus*, *Lithodes aequispina*, and *L. couesi*), and Tanner crab (*Chionoecetes sp.*) (listed as prohibited species in Table 1 of this part) caught by a vessel regulated under this part while fishing for groundfish in the Bering Sea and Aleutian Islands

management area, unless retention is authorized by other applicable law, including the regulations of the International Pacific Halibut Commission."

In Table 1, §675.20, the column heading "Unallocated species" would be changed to "Prohibited species" and the species listed in this column would be limited to salmon, Pacific halibut, Pacific herring, king crab, and Tanner crab. In addition, footnote 1 would be changed to read: "Must be treated in accordance with paragraphs (c)(2), and (c)(3) of this §675.20."

NOTE: Changes from the March 11, 1987 draft EA/RIR/IRFA include addition of Pacific herring, scientific names in domestic regs, and minor editorial corrections.

4.0 IMPROVE CATCH RECORDING REQUIREMENTS

4.1 Description of and Need for the Action

Catch Verification and Enforcement

The domestic groundfish fishery is rapidly displacing the foreign groundfish fishery in the U.S. EEZ off Alaska. The domestic harvest exceeded the foreign harvest for the first time in 1986. The groundfish catch by U.S. fishermen has grown from 8,600 mt in 1979 to over 1.4 million mt in 1986. Although domestic trawlers fishing in joint ventures with foreign processors are responsible for the majority of this increase, a rapidly growing fleet of U.S. catcher/processor and mothership vessels are contributing to a rapidly growing wholly U.S. catching and processing industry.

Catcher/processor and mothership vessels, like vessels landing their catch at shoreside processors, must complete State of Alaska groundfish fish tickets. Because these vessels land infrequently, however, they are required to submit an additional weekly catch report directly to NMFS. The accuracy of catch information reported on State fish tickets by groundfish vessels landing their catch shoreside can be easily verified by observing the off-loading, sorting, and weighing of the catch at shoreside processing establishments. In this manner NMFS is able to guard against gross under-reporting of catch or misrepresentation of the species caught.

Catcher/processor and mothership vessels, on the other hand, often off-load processed catch at sea for direct transport to foreign or domestic destinations. No record is currently required of the amount of product off-loaded. Furthermore, because product may never come ashore where NMFS can verify the accuracy of the reported catch, no means exists to verify the accuracy of either the State fish tickets or the weekly catch reports submitted by catcher/processor and mothership vessels. Thus, NMFS is unable to enforce effectively those regulations, such as bycatch restrictions and gear quotas, that require an accurate accounting of the amounts of each groundfish species harvested.

The extent of current under-reporting is unknown, but past experience in foreign fisheries indicates that as much as 25-50% of annual harvests taken by catcher/processors or purchased by motherships may have been unreported. NMFS proposes to meet the need to verify reported catches from domestic catcher/processor and mothership vessels by requiring these vessels to maintain on board a Daily Cumulative Production Log (DCPL) and a transfer logbook.

The DCPL would contain daily and cumulative production totals for finished product on a species and product-type basis. It would also include basic information on where and when fishing occurred. The transfer logbook would contain a record of all off-loadings, also according to species and product type. The transfer logbook would also include the name of the vessel transporting the product, date of off-loading, and the port of destination. Thus, the subtraction of the cumulative amount of product off-loaded from the cumulative production recorded in the DCPL would result in the amount of product remaining on board. By this means, NMFS would be able to verify the accuracy of all catch reports by examining the DCPL and transfer logs either during a vessel boarding or subsequent to the season after all logbooks are returned.

The DCPL and transfer logbook would not terminate the requirement for State fish tickets from catcher/processors and motherships. However, NMFS recognizes that the full implementation of the DCPL and transfer logbook system combined with the weekly catch reports would eliminate the need for State fish tickets from this vessel group. If NMFS is satisfied that the logbook and reporting system functions as planned to monitor and verify the accuracy of catches, then NMFS would propose to eliminate the federal requirement for a State fish ticket from catcher/processor and mothership vessels.

The DCPL, transfer logbook, and weekly catch report are all expected to be accurate to the nearest .01 mt (20 lbs.). NMFS recognizes that some enforcement discretion will be necessary to avoid prosecutions for minor bookkeeping errors. NMFS is not concerned with minor discrepancies but is mainly interested in preventing intentional, gross under or mislogging of valuable groundfish species.

NMFS proposes that the DCPL, transfer logbook, and the presently required weekly catch reports all be completed by species and finished product type. Current regulations require the weekly catch report to be by round weight by species which requires the vessel operator to convert from finished product back to round weight. NMFS proposes to relieve that burden from the vessel operator by requiring only the reporting of finished product. NMFS will publish a list of standard product conversion rates at the beginning of the year which will be used to convert the weekly reports to round weight for the purpose of monitoring overall quotas for gear types and regulatory areas. This requirement would further contribute to better enforcement and more accurate catch reporting by removing any incentives for vessel operators to manipulate product conversion rates in order to "stretch" quotas of valuable groundfish species.

Fishing Effort and Discards

The foreign fisheries off Alaska have supplied much valuable biological and fishery performance information through the logbook and observer programs. This information has contributed to stock assessment programs at the Northwest and Alaska Fisheries Center and to the development and evaluation of potential management measures. As foreign harvesting and processing is replaced by wholly domestic operations in the EEZ, much of this information will no longer be available to the NMFS and the North Pacific Fishery Management Council.

Currently, no comprehensive observer program for domestic vessels exists. Domestic vessels also currently are not required to maintain logbooks or to supply information on catch per unit of effort and other fishery performance information. The absence of an observer program and effort logbooks for domestic vessels coupled with the gradual phasing out of the foreign fisheries will result in a gradual loss of the quantity and quality of biological and fisheries performance information necessary for management of the fisheries.

Therefore, NMFS proposes to expand the DCPL to incorporate a comprehensive fishing log as a partial step to prevent the loss of valuable fishery performance information during the transition from a foreign dominated to a wholly U.S. groundfish fishery. The DCPL would be expanded to include information on fishing effort and gear and an estimate of the discards of non-commercial and unwanted groundfish species.

The fishing effort and gear section of the log would require information relating to the gear type, gear attributes (e.g., mesh size), fishing area, amount of gear fished, and detailed information concerning fishing effort including set and haul times, set and haul positions (latitude and longitude), water depth, and the depth of each set or haul. The estimate of discards would require only a daily estimate by species. Estimates of discards is needed to obtain information relating to the total removals and mortalities from the groundfish complex.

Most vessel operators normally keep similar fishing effort and catch logs to facilitate their own fishing operations. NMFS proposes to design the fishing logbook in cooperation with the fishing industry to combine into a single format the basic information normally used by vessel operators with that needed for the development and evaluation of management measures and that to be required for catch verification and enforcement.

Consolidating each vessel's recordkeeping into a comprehensive fishing logbook which includes the DCPL should satisfy the information requirements of the vessel operator, the Council, and NMFS in an efficient and concise manner.

NMFS proposes to initially require the maintenance of a comprehensive fishing logbook only for catcher/processor and mothership vessels. Because the DCPL section of the log is essential for these vessel classes, NMFS believes the addition of the fishing effort and discard sections of the fishing logbook can be accomplished relatively easily. NMFS recognizes that the same fishing effort and discard information is not currently being collected from other segments of the groundfish fleet, such as trawlers delivering shoreside and longline vessels, except for that collected through short-term voluntary observer programs. The need to collect this information from other segments of the groundfish fleet might be met either by expanding the coverage of the fishing effort and discard sections of the fishing log to all elements of the groundfish fleet as suggested in Alternative 2 or by deferring the expansion to a later FMP amendment.

4.2 Alternatives Including the Action

Four alternatives are considered, including the status quo. Alternatives 2 and 3 are directed only at vessels that are 5 net tons or larger.

4.2.1 Alternative 1: Do not require the DCPL, comprehensive fishing logbook or the transfer logbook (status quo).

4.2.2 Alternative 2: Require catcher/processor and mothership vessels to document their operations by maintaining a fishing logbook which includes daily cumulative production log (DCPL), fishing effort, and discard sections, and a transfer logbook. Other groundfish vessels over 5 net tons would be required to maintain the fishing effort and discard sections only.

4.2.3 Alternative 3: Require only catcher/processor and mothership vessels to maintain a comprehensive fishing logbook (including DCPL, fishing effort, and discard sections) and a transfer logbook. Other vessel categories would have no logbook requirements.

4.2.4 Alternative 4: Require catcher/processor and mothership vessels to maintain only the DCPL logbook section and the transfer logbook. The fishing effort and discard sections would be deleted from the fishing logbook.

4.3 Biological and Physical Impacts

4.3.1 Alternative 1: Do not require the DCPL, comprehensive fishing logbook or the transfer logbook (status quo).

This alternative would prevent full accounting for amounts of groundfish that are removed from the ecosystem, and may thus increase the risk of overfishing. Improved accounting of amounts of groundfish that are removed from the ecosystem is necessary to lessen the risk of overharvesting groundfish stocks. Under Alternative 1, environmental impacts that might occur as a result of overharvesting groundfish stocks include changes in predator-prey relations among invertebrates and vertebrates, including marine mammals and birds, physical changes as a direct result of on-bottom fishing practices, and nutrient changes due to processing and dumping of fish wastes.

4.3.2 Alternative 2: Require catcher/processor and mothership vessels to document their operations by maintaining a fishing logbook which includes daily cumulative production log (DCPL), fishing effort, and discard sections, and a transfer logbook. Other groundfish vessels over 5 net tons would be required to maintain the fishing effort and discard sections only.

This alternative would provide additional data needed for stock assessment and the evaluation of management measures through the collection of information on fishing effort and discards from the entire groundfish fleet. It would promote enforcement of catch reporting through the maintenance of the DCPL and the collection of information on amounts of groundfish that have been off-loaded, thereby improving information on total fish removals. Therefore, Alternative 2 would contribute to the prevention of the overharvest of groundfish stocks and thus reduce the risk of overfishing.

4.3.3 Alternative 3: Require only catcher/processor and mothership vessels to maintain a comprehensive fishing logbook (including DCPL, fishing effort, and discard sections) and a transfer logbook. Other vessel categories would have no logbook requirements.

This alternative would provide less data on fishing effort and discard needed for stock assessment and for evaluation of management measures, because it would only apply to catcher/processor and mothership vessels and not to all vessels that harvest groundfish. An incomplete information base is more likely to result in possible overharvest then the information base generated under Alternative 2.

4.3.4 Alternative 4: Require catcher/processor and mothership vessels to maintain only the DCPL logbook section and the transfer logbook. The fishing effort and discard sections would be deleted from the fishing logbook.

This alternative would verify the accuracy of catch records and enforce groundfish regulations, but would do little to replace the biological and fisheries performance data currently collected from the foreign fisheries. To the extent that the loss of this data might result in potential overharvest, the risk of overfishing is greater than under Alternatives 2 and 3, but less than under Alternative 1.

4.4 Socioeconomic Impacts

4.4.1 Alternative 1: Do not require the DCPL, comprehensive fishing logbook or the transfer logbook (status quo).

No changes in reporting costs incurred by fishermen or floating processors would occur. No additional administrative, enforcement, or information costs would occur. However, the need for credible biological and fisheries performance information would still exist. Alternative ways of collecting this information, such as onboard observers and increased research vessel time would impose costs on society, fishermen, or both. Potential costs resulting from declining groundfish stocks, and thus allowable harvest, caused by under reporting and possible overfishing are not estimable but may become substantial.

4.4.2 Alternative 2: Require catcher/processor and mothership vessels to document their operations by maintaining a fishing logbook which includes daily cumulative production log (DCPL), fishing effort, and discard sections, and a transfer logbook. Other groundfish vessels over 5 net tons would be required to maintain the fishing effort and discard sections only.

Costs that would be incurred by all groundfish fishermen with vessels larger than 5 net tons are associated with completing the fishing effort and discard sections of the fishing logbook. Catcher/processor and mothership vessels would also need to complete the DCPL section and the transfer logbook. Based on the NMFS data base on groundfish permits issued for 1987, there are 972 catcher vessels, 188 catcher/processors, and 2 mothership vessels, which is a maximum of 1,162 vessels that would be required to complete the fishing effort and discard sections of the fishing logbook. The 188 catcher/processors identified in the NMFS licensing data base includes 27 using trawl gear with the remainder being hook-and-line and pot vessels.

Costs of complying with this information collection requirement are those resulting from having to complete and maintain the logbooks. These costs are derived by estimating the total fleet vessel-days during a year for which records might be required, multiplying vessel-days by the number of minutes each respondent might spend in filling out a log, and then dividing by 60 minutes to obtain the total number of hours per year that might be spent by DAP fishermen to maintain these logbooks. NMFS estimates that an average of about 15 minutes and 30 minutes per day would be required for catcher vessels and catcher/processor vessels, respectively, to complete the fishing effort section of the fishing logbook. About 10 minutes per day would be required to complete the Discard section of the logbook. About 30 minutes per day would be required to complete the DCPL section and about 10 minutes per day would be required to complete the Transfer Logbook. Costs across the fleet to comply with these new requirements are estimated as follows:

Fishing Logbook

Fishing effort section - Assuming catcher vessels average about 20 days fishing each month and fish for an average of three months each year, then 972 catcher vessels would fish for an estimated 58,320 vessel-days. Completing the fishing effort section of the fishing logbook, at 15 minutes per log per day would require 14,580 hours per year. If catcher/processor vessels average 20 days fishing each month for an average of six months, then 188 catcher/processor vessels will fish for 22,560 vessel-days per year. Completing fishing effort sections by this class of vessels at 30 minutes per log would require 11,280 hours per year. Thus, the maximum total costs on all DAP vessels to complete the fishing effort section is about 25,860 hours per year.

Discard section - If the 188 catcher/processor and two mothership vessels were to average 20 days fishing for an average of six months per year, then these vessels would fish for an estimated 22,800 vessel-days per year. Completing the discard section of the fishing logs at 10 minutes per log per day would require 3,800 hours per year. The 972 catcher vessels would spend 9,720 hours per year completing the discard section. Thus, the maximum total costs on all DAP vessels to complete the discard log is about 13,520 hours per year.

DCPL section - If the 188 catcher/processor and two mothership vessels were to fish for an average of 20 days per month for an average of six months per year, then these vessels would also fish for an estimated 22,800 vessel-days per year. Assuming it takes 30 minutes per day to complete the DCPL, the maximum total hours spent to complete the DCPL is 11,400 hours per year.

Transfer Logbook

If the 188 catcher/processor and two mothership vessels were to transfer catch at the rate of once every two weeks (bi-monthly) for an average of six months per year, then these vessels would make a total of 2,280 transfers. Completing transfer logs at 10 minutes per log would require a maximum of 380 hours.

The amount of time to complete these logbooks is not necessarily an added cost to fishermen. The respondents likely keep these records anyway. Alternative 2 may actually provide a benefit to fishermen by supplying the log books that they would use.

Under Alternative 2, certain costs would be incurred by resource agencies in administering and enforcing the data collection program. NMFS estimates that the amount of time to board and inspect a catcher vessel, catcher/processor or mothership vessel, including their logbooks is about one hour per catcher vessel and two hours per catcher/processor or mothership. If 5% of the 972 vessels were boarded and inspected, about 49 hours would be required complete the inspections. If 50% of the 188 catcher/processor and two mothership vessels were boarded and inspected, then about 190 hours would also be required to inspect 95 vessels. Costs are those included in utilizing support platforms, e.g., U.S. Coast Guard vessels. No additional costs, however, are borne by agencies. Enforcement personnel are already hired to support the conservation and management roles of NMFS. U.S. Coast Guard vessels are in place to carry out search-and-rescue and fisheries enforcement missions off Alaska. Depending on the type of program instituted for obtaining and analyzing logbook information, certain costs would also be incurred by the NMFS.

4.4.3 Alternative 3: Require only catcher/processor and mothership vessels to maintain a comprehensive fishing logbook (including DCPL, fishing effort, and discard sections) and a transfer logbook. Other vessel categories would have no logbook requirements.

Costs that would be incurred by catcher/processor and mothership vessels are those that are associated with completing the entire fishing logbook and transfer logbook. Based on the NMFS data base on groundfish permits issued for 1987, there are 188 catcher/processor vessels and two mothership vessels, or 190 vessels that could complete the logbooks. The costs to vessel operators of complying with this information collection requirement are summarized above under Alternative 2. The maximum costs for the catcher/processor and mothership/processor fleet to comply with these new requirements are estimated to be 45,480 hours.

Under Alternative 3, certain costs would be incurred by resource agencies in administering and enforcing the data collection program. NMFS estimates that the amount of time to board and inspect catcher/processor and mothership/processor vessels, including their logbooks is about two hours. If 50% of the 188 catcher/processor and two mothership vessels were boarded and inspected, then about 190 hours would be required to inspect 95 vessels. Costs are those included in utilizing support platforms, e.g., U.S. Coast Guard vessels. No additional costs, however, are borne by agencies. Enforcement personnel are already hired to support the conservation and management roles of the National Marine Fisheries Service. U.S. Coast Guard vessels are in place to carry out search-and-rescue and fisheries enforcement missions off Alaska. As discussed for Alternative 2, certain costs associated with analyses of data from logbooks also be incurred by the National Marine Fisheries Service, and the relative value of data from commercial fisheries compared to that obtained from NMFS programs would depend on the types of programs that were established.

4.4.4 Alternative 4: Require catcher/processor and mothership vessels to maintain only the DCPL logbook section and the transfer logbook. The fishing effort and discard sections would be deleted from the fishing logbook.

Under Alternative 4 only the DCPL section of the fishing logbook and the transfer logbook would be maintained by the catcher/processor and mothership fleet. Based on the data discussed earlier, NMFS estimates that a maximum of 22,800 hours per year would be spent by the fleet in compliance with this requirement.

5.0 REVISE THE DEFINITION OF ACCEPTABLE BIOLOGICAL CATCH

5.1 Description of and Need for the Action

Recent efforts by the Scientific and Statistical Committee have led to a review of terminology and development of new working definitions. Some of this work has already been incorporated in FMPs. A revised definition of ABC has been proposed by the committee to reflect current wording recently adopted by the Pacific Fishery Management Council for use in its groundfish FMP for purposes of conformity. Adoption of the revised definition would standardize this term for groundfish fisheries management along the entire west coast of the United States.

5.2 The Alternatives

5.2.1 Alternative 1: Do nothing - Status Quo.

Adoption of Alternative 1 would leave the following definition for acceptable biological catch unchanged:

Acceptable biological catch (ABC) is a seasonably determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitments. The Council can set the ABCs for individual species anywhere between zero and the maximum possible removal based on the best scientific information presented by the Plan Team and/or Scientific and Statistical Committee. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the maximum sustainable yield exploitation rate multiplied by the size of the biomass for the relevant time period. The ABC is defined as zero when the stock is at or below its threshold.

5.2.2 Alternative 2: Revise the definition for acceptable biological catch to bring it into conformity with the definition used by the Scientific and Statistical Committee and the Pacific Fishery Management Council.

Approval of this alternative would replace the existing definition of ABC with the following:

Acceptable biological catch (ABC) is a seasonally determined catch or range of catches that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitments. Given suitable biological justification by the Plan Team and/or Scientific and Statistical Committee, the ABC may be set anywhere between zero and the current biomass less the threshold value. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the maximum sustainable yield exploitation rate multiplied by the size of the biomass for the relevant time period. The ABC is defined as zero when the stock is at or below its threshold. The threshold is defined as the minimum size of a stock that allows sufficient recruitment so that the stock can eventually reach a level that produces MSY.

Approval of Alternative 2 would bring the working definition of ABC into conformity with other groundfish FMPs. Since these revision is only descriptive, no implementing regulations or accompanying regulatory analysis is necessary.

5.3 Biological and Physical Impacts

5.3.1 Alternative 1: Do nothing - status quo.

Under the status quo, confusion within management and the fishing industry with regard to the ABC definition would continue.

5.3.2 Alternative 2: Revise the definition for acceptable biological catch (ABC) to bring it into conformity with the definition used by the Scientific and Statistical Committee and the Pacific Fishery Management Council.

This amendment addresses an administrative revision and will have no effect on the environment. Both the Gulf of Alaska FMP and the Bering Sea/Aleutian Islands Groundfish FMP define a term ABC for use as a biological reference point when making management decisions. Recently the North Pacific Council's Scientific and Statistical Committee has revised the definition of ABC for purposes of clarification. This amendment revises the existing definition to conform with the current interpretation of ABC and with definitions in other groundfish FMPs.

5.4 Socioeconomic Impacts

Alternative 2 is an administrative amendment and will have little socioeconomic impact since the amendment only addresses terminology. However, determination of thresholds may consume considerable resources as scientific staff develops a theoretical model or empirical data to identify threshold population levels for the managed groundfish stocks. Since ABC is used as a biological reference point when setting quotas it could have some socioeconomic effects. If the quota were set lower as a result of ABC, then the total groundfish harvest and associated economic value in that year will likely also be reduced. It should be realized that such a reduction would be based on biological rationale and that such a quota reduction in the current year could lead to increased or more sustainable quotas in future years. Any positive benefits of revising the definition will be shared by all who participate in the groundfish fishery. Neither alternative is expected to affect the quality or the price of groundfish products to the consumer.

6.0 INCREASE THE UPPER LIMIT OF THE OPTIMUM YIELD (OY) RANGE

6.1 Description of and Need for the Action

Amendment 1 to the Bering Sea/Aleutian Islands Groundfish FMP established a single optimum yield (OY) for the groundfish complex in the BS/AI equal to a range of 1.4-2.0 million mt, a range defined as equal to 85% of the sum of single species maximum sustainable yield (MSY). The complex has 10 commercial species or species groups of groundfish. Annually the OY for the complex is generally set equal to the sum of the total allowable catch (TAC) for the component species, but within the OY range. Each year the Council determines TAC for each species using the best available information concerning the acceptable biological catch (ABC) or equilibrium yield (EY) for each species as well as socioeconomic information. Currently, the sum of the TACs cannot exceed 2.0 million mt, or be less than 1.4 million mt, without amending the definition of OY in the FMP.

Maximum sustainable yield for the groundfish complex is estimated to be 1.7-2.4 million mt. This amount is equal to the sum of the MSYs for the major individual species groups. Ecosystem models, however, indicate that MSY may exceed 2.4 million mt. These models simulate the dynamics of the principal components of the Bering Sea/Aleutian Islands ecosystem and indicate that the minimum exploitable groundfish biomass may be at least 9.5 million mt. A harvest of 2.4 million mt from an exploitable population of 9.5 million mt represents a 25% exploitation rate--a rate that is considered acceptable for most fisheries.

When Amendment 1 to the Bering Sea/Aleutian Islands groundfish FMP was developed and implemented, the sum of individual species EYs/ABCs was below the upper end of the OY range. Recruitment of several strong year classes of groundfish has, however, enhanced the condition of several stocks, which have thus increased in biomass. As a result, EYs/ABCs have increased steadily from a sum of 1.5 million mt in 1977 to a peak of 2.25 million mt in 1984. The current upper limit on the OY has constrained the Council during some years from setting a total sum of TAC at a level that would allow for fuller utilization of surplus production. This constraint has occurred during four of the last five years--1983, 1984, 1985 and 1987, when EYs (representing ABC) have exceeded 2.0 million mt (Table 6.1). Although the sum of EYs/ABCs has declined slightly in more recent years, biological indicators suggest that the sum of EYs/ABCs is expected to continue to exceed 2.0 million mt in future years as a result of conservation and management measures now made possible under the Magnuson Act. An increase in the upper end of the OY range would provide the Council and the Secretary of Commerce broader latitude to fully utilize the groundfish resources. Conversely, maintaining a cap of 2.0 million mt could provide an additional measure of protection to the groundfish stocks.

6.2 The Alternatives

6.2.1 Alternative 1: Do nothing - status quo. Maintain the upper end of the OY range at the current level of 2.0 million mt.

This alternative maintains a conservative management system, limiting OY to 85% of estimated MSYs, that was implemented by Amendment 1 to the FMP. It

Table 6.1 Estimated MSY, EY, and OY (1,000s mt) for the groundfish complex in the Bering Sea/Aleutian Islands Area.

Year	MSY*	EY	OY
1977	1,627-2,251	1,486	1,368
1978	1,627-2,251	1,485	1,486
1979	1,627-2,251	1,571	1,486
1980	1,627-2,251	1,791	1,571
1981	1,630-2,307	1,910	1,579
1982	1,677-2,351	1,928	1,579
1983	1,676-2,223	2,127	1,624
1984	2,086-2,212	2,248	2,000
1985	2,095-2,220	2,188	2,000
1986	2,037-2,143	1,912	2,000
1987	2,108-2,163	2,199	2,000

*Note: Total annual MSY fluctuates within the FMP range of 1.7-2.4 million mt to reflect new information obtained about the conditions of various groundfish species.

provides the Council and the Secretary with limited flexibility to make groundfish available for harvest when the status of stocks indicate ABCs greater than 2.0 million mt.

6.2.2 Alternative 2: Increase the upper end of the OY range to 2.4 million mt.

This alternative would provide broader flexibility to make groundfish available for harvest during years when the biological status of stocks (ABC) indicate a harvestable surplus larger than 2.0 million mt. The upper estimate of MSYs equals 2.4 million mt, forming the justification for an upper OY value of 2.4 million mt; however, it should be noted that EY for the groundfish complex has not exceeded 2.25 million mt.

6.2.3 Alternative 3: Set the upper end of the OY range equal to the sum of the annual estimates of ABC.

This alternative would provide a definition of optimum yield that would be more directly responsive to estimated conditions of changing stock sizes. The status quo limits OY to 85% of the estimated range of MSY, and Alternative 2 limits the upper value of OY to 100% of the high estimate of MSY; however, estimates of MSY are long-term average values and often are not representative of short-term (5-10 year) variations due to the occurrence of exceptionally strong or weak year-classes. Equating the upper end of the OY range to the sum of annually calculated ABCs for the groundfish complex would not only remove an "artificial" constraint to annual decisions on OY, but would provide a conservation-based upper limit to OY and subsequent allocation decisions. Socioeconomic concerns could be used to set individual TACs, and consequently OY, at levels lower than the sum of ABCs.

The present practice of simply summing groundfish MSYs has no real bearing on allowable harvest during any particular year. Annual harvests are more reasonably constrained by annual estimates of stock condition and harvest levels that are established to move stock sizes toward those that will achieve long-term MSY. On an annual basis many fisheries cannot be harvested at MSY because their stock sizes are not large enough to support such harvests and require rebuilding. For example, Greenland turbot stocks are currently reduced so that ABC for 1987 is estimated at 15,000 mt whereas long-term MSY is estimated at 38,500 mt per year. At the other extreme, as in recent years for Pacific cod, stock size may support yields far in excess of MSY for a number of years. Long-term MSY for Pacific cod is estimated at 59,000 mt per year, but EY for 1987 is estimated at 400,000 mt.

6.2.4 Alternative 4: Set the upper end of the OY range equal to the sum of the annual estimates of ABC or to 2.0 million mt, whichever is less.

This alternative would restrict flexibility to make groundfish available for harvest, by maintaining the existing constraint of 2.0 million mt and by adding a further conservative restriction on OY if the sum of the annual estimates of ABC is less than 2.0 million mt. Thus, this alternative encompasses the conservation limits imposed by Alternative 3 but maintains the "artificial" upper constraint of the existing 2.0 million mt limit to OY.

6.3 Biological and Physical Impacts

Environmental impacts on the quality of the human environment are categorized as biological, physical, and socioeconomic. Biological and physical impacts are discussed as follows:

6.3.1 Alternative 1: Do nothing - status quo. Maintain the upper end of the OY range at the current level of 2.0 million mt.

Impacts caused by maintaining the upper end of the OY range at 2.0 million mt can be categorized as impact to groundfish, marine mammal and bird populations, and physical impacts as a direct result of on-bottom fishing practices.

Impact to Groundfish Populations

The EY/ABC for the groundfish complex is usually calculated on a species-by-species basis and summed for the groundfish complex. These calculations account for amounts consumed by other groundfish and other natural mortality. The EY/ABC is the estimated "surplus production" which can be harvested without altering the level of biomass present from one year to another. The harvest of surplus production should not adversely impact the well-being of groundfish populations since the fish harvested are those amounts in excess of equilibrium. The species-by-species estimates of EY or ABC form the biological limit for setting of TACs for the groundfish complex. When OY is set equal to the sum of the individual species ABCs (and/or EYs) the existing multispecies trawl-dominated fishery cannot harvest the entire amount without exceeding the ABC of some species in the complex. Consequently, total catches will generally never achieve the combined ABCs for the groundfish complex. Thus, the present management system will provide for the maintenance of a larger resource biomass than otherwise would be the case and a "biological cushion" will exist to compensate for variations and errors in ABC determinations. Moreover, when the EY/ABC exceeds 2.0 million mt, additional conservation is achieved by maintaining a cap on OY.

Impact to Marine Mammals and Birds

Under this alternative, fishermen would be limited to no more than 2.0 million mt. During some years when the condition of stocks might allow a harvest of more than the upper limit of 2.0 million mt (i.e., ABCs greater than 2.0 million mt), a surplus of groundfish biomass would be available in the system. This unharvested surplus would be consumed by marine mammals and birds only if the surplus was comprised of juvenile and young fish used by these predators. Higher abundance of younger aged fish due to restricted harvests of older fish would only be expected if a definite spawner-recruit relationship exists; however, no such relationship has been well defined for BS/AI groundfish. Competition between fishermen and marine mammals and birds, if any, would be lessened during such years; however, competition between older aged groundfish and birds and mammals feeding on younger groundfish may increase.

Physical Impact as a Direct Result of On-bottom Fishing Practices

No identifiable changes are expected under the status quo.

6.3.2 Alternative 2: Increase the upper end of the OY range to 2.4 million mt.

Impacts caused by a change in the OY range are categorized as impact to groundfish populations, marine mammals, and marine birds, and physical impacts as a direct result of on-bottom fishing practices.

Impact To Groundfish Populations

If the upper end of the OY range is changed to 2.4 million mt, the Council would have greater management flexibility to more fully utilize the resource when stock conditions warrant it, as estimated by ABC and/or EY. The Council could still consider such factors as biological, environmental, and socioeconomic in setting single species TACs below, at, or above ABCs within the OY range. If OY would be limited by the sum of ABCs, no adverse impacts to the groundfish complex are anticipated. However, if the sum of EYs/ABCs were less than 2.4 million mt, then harvesting at the upper value of OY could endanger the groundfish stocks. Past performance of the Council, however, indicates their reluctance to allow harvests above EY/ABC even if below the upper OY value.

Impact to Marine Mammals

Pinniped species found in the Bering Sea/Aleutians are all protected by the Marine Mammal Protection Act of 1972 (MMPA). Permits for incidental taking of these species in groundfish fisheries may be issued under certain circumstances. Because groundfish trawl operations generally involve conflict with pinnipeds, domestic and foreign fishermen proposing to engage in such operations must obtain Certificates of Inclusion under a general permit for the taking of marine mammals incidental to commercial trawling operations. Under the general permit only small numbers of northern sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), harbor seals (*Phoca vitulina*), and small cetaceans may be killed or seriously injured annually by domestic trawl operations off Alaska.

Numbers of marine mammals taken in the eastern Bering Sea and the North Pacific Ocean have been well within the limits provided by the Certificates of Inclusion. A total of 73 and 96 marine mammals were reportedly taken during the joint venture and foreign fisheries in 1984, respectively. In the same year, an additional 274 and 93 marine mammals were taken in joint venture and foreign groundfish operations in the rest of the North Pacific. U.S. fishermen now have several years of experience in the Bering Sea groundfish fishery and are mostly familiar with the protection afforded marine mammals. Observations by the National Marine Fisheries Service suggest, however, that trawling conducted during periods of darkness is likely to increase encounters with marine mammals. Potential methods to reduce such encounters include scheduling fishing operations to reduce or eliminate the need to trawl during periods of darkness. Fishermen should be encouraged to consider and adopt such measures to mitigate the effect of their operations on sea lions in order to enjoy fishing activities without additional measures that could be imposed on them under the MMPA. An inreased harvest level of 2.4 million mt is not expected to result in non-compliance with taking provisions of the MMPA.

Twelve species of marine mammals (Table 6.2) may be affected by commercial fishing for eight fish species or fish groups in the eastern Bering Sea (Proceedings of the Workshop on Biological Interactions Among Marine Mammals and Commercial Fisheries in the Southeastern Bering Sea, Alaska Sea Grant, University of Alaska 1984). Ecosystem models have been used to examine the interactions that occur between marine mammals and commercial fishing operations, primarily considering competition for food. The results from these models suggest that marine mammals are not effected by current or proposed levels of OY and increasing the OY or TAC to 2.4 million mt should not deprive marine mammal populations of food.

While most species of marine mammals are described to be at optimal sustainable population (OSP), three species (northern fur seal, Steller sea lion, and harbor seal) appear to have declined in abundance from levels recorded in earlier periods. Northern fur seals and Steller sea lions have declined to about half their numbers evident in the 1960s. In the eastern Aleutian Islands the sea lion population may have declined by 70% over the past 25 years. However, no explicit connection has yet been discovered between these declines and the harvest or status of groundfish stocks.

Types of interactions between marine mammals and commercial fishing operations have been divided into four categories as follows:

(a) Direct effects on marine mammals from shooting, harassment, incidental entanglement during fishing operations, and/or entanglement in lost or discarded fishing gear.

(b) Direct effects on fisheries when marine mammals take or damage caught fish, and/or damage fishing gear.

(c) Indirect effects on marine mammals caused by fisheries reducing the quantity or quality of prey species available to marine mammals.

(d) Indirect effects on fisheries caused when marine mammals reduce the quantity or quality of fish available to fisheries.

Except for entanglement in lost or discarded fishing gear, direct interactions are reasonably well documented and/or are the subject of ongoing or planned assessment. Categories (c) and (d), indirect ecological interactions as a result of changes in predators and prey species, are less well understood. Most of the marine mammals, particularly fur seals, feed on juvenile groundfish and compete with groundfish for some prey species. Harvesting an increased amount of adult groundfish is not expected to limit marine mammal forage because the fishery takes predominantly adult fish rather than competing for juveniles. In addition, harvesting of groundfish stocks reduces predation of juvenile groundfish by adults, thereby possibly reducing competition with marine mammals. In the case of fur seals, it has been shown that individual seals have been well fed and that population declines may not be due to food availability. In reality, predator/prey relationships are not well understood and any resulting changes are not possible to measure against natural perturbations in the ecosystem, given the existing technology to measure them.

Table 6.2 Marine mammals and commercial fish species in the Eastern Bering Sea that interact as a result of commercial fishing operations.

Marine Mammals	Fish Species
Northern fur seal (Callorhinus ursinus)	Pollock
Steller sea lion (Eumetopias jubatus)	Pacific cod
North Pacific walrus (Odobenus rosmarus)	Yellowfin sole
Harbor seal (Phoca vitulina)	Turbot
Spotted seal (Phoca largha)	Other flounders
Ribbon seal (Phoca fasciata)	Halibut
Bearded seal (Erignathus barbatus)	Rockfish
Beluga whale (Delphinapterus leucas)	Sablefish
Dall porpoise (Phocoenoides dalli)	
Harbor porpoise (Phocoena phocoena)	
Gray whale (Eschrichtius robustus)	
Humpback whale (Megaptera novaengliae)	

Interactions are most likely to occur in the following combinations of marine mammals and commercial fisheries:

Northern fur seal -- pollock/cod
Steller sea lion -- pollock/cod
Harbor seal -- yellowfin sole/flounder

The nature of these interactions are summarized as follows:

Northern Fur Seal and the Pollock/Cod Fishery - Fur seals prey primarily upon one and two year old pollock, whereas the fishery preferentially takes larger sizes and older ages of pollock. Ecological interactions potentially are greatest in the vicinity of the Pribilof Islands during the fur seal pupping/breeding season. The Pribilof Island fur seal population has been declining since the mid-1950s. The harvest of females in the late 1950s and early 1960s accounts for much of the decline; and, while not proven, entanglement in lost or discarded fishing gear could be a major cause of the continued decline. If OY were to increase, then there is a possibility that more fishing gear could be lost, adding to the impact of derelict gear on fur seals.

Obtaining the necessary biological/ecological information to predict the probable numerical and functional relationships between the northern fur seal population, the pollock/cod fishery, and the affected fish stocks would be difficult. In such cases, baseline/monitoring programs would have to be conducted to detect and monitor possible harvest-caused changes in key population or system parameters.

Steller Sea Lion and the Pollock/Cod Fishery - Populations of Steller sea lions in the eastern Bering Sea apparently have declined in recent years. The NMFS has conducted surveys of entangled sea lions in the Aleutian Islands and concluded that the low incidence of entanglement among adults and sub-adults is not sufficient to have caused the population decline that has been observed. It is not clear whether entanglement of juvenile sea lions is significant and is contributing to the decline.

Unlike the northern fur seal, the Steller sea lion is present in the eastern Bering Sea year-round. The distribution, origins, trends and diet of Steller sea lions, however, are not well documented. From what little is known about their diet it appears that many sizes of pollock, 5 cm to 60 cm, are eaten. Some dietary information have been obtained from animals caught incidentally in the cod end of trawl nets and may be biased since sea lions are known to be attracted to, and feed in, the vicinity of fishing and processing vessels. Too little is known about entanglement in lost and discarded fishing gear and about the distribution, feeding habits, and food requirements of Steller sea lions in the eastern Bering Sea to do more than speculate about the possible direct and indirect effects of the pollock/cod fishery on the eastern Bering Sea population(s) of Steller sea lions.

Harbor Seal and the Yellowfin Sole Fishery - The harbor seal is a coastal species inhabiting nearshore areas where groundfish fishing effort is minor. Thus, harbor seals probably will not be affected by the yellowfin sole fishery unless there is a substantial expansion of nearshore fisheries in the eastern Bering Sea. The nature and size of inshore domestic fisheries; the movements, feeding habits, and diet of harbor seals; and the existence, location and characteristics of definable harbor seal feeding areas are not well documented.

Changes in ABCs and the level of optimum yield are calculated to account for amounts of groundfish consumed by marine mammals (i.e., fisheries are only allowed on surplus production); therefore, increases in OY based upon ABCs should not impact the food available for marine mammals. On the other hand, certain conflicts occur between marine mammals and fishermen as a result of both "predators" being on the same grounds, sometimes in direct competition or interference with each other.

While it may be reasoned that increasing the OY to 2.4 million mt (a 25% increase from status quo) may not necessarily be detrimental to marine mammals, the poor status of some marine mammal populations may actually have a serious implication on the operation of the fisheries. The northern fur seal is currently under review for listing as a depleted species, and the Steller sea lion is likely to be proposed for such review in the near future. If either species is declared depleted under the MMPA, then the incidental take of the species during groundfish operations may be denied or severely restricted. As such, it could require cessation or significant regulation of the fisheries.

Impact to Marine Birds

Harvesting operations during the groundfish fisheries may cause marine birds, including those protected by the Migratory Bird Treaty Act, to avoid areas that they might otherwise frequent. Such displacement of these birds would not appear to be a prohibited taking for purposes of the Migratory Bird Treaty Act, but its long-term effect on them is largely unknown. Birds protected under this Act could theoretically be captured in trawl gear in the course of their feeding activities. Any such capture that is intentional or negligently caused by fishermen would be a violation of this Act.

As with marine mammals, many of the marine birds that occur in the Bering Sea/ Aleutians feed on juvenile groundfish that are taken by the fisheries. They also feed on prey species consumed by groundfish. Marine birds generally consume small fish prior to their recruitment to the fishery and in competition with commercial fish species for prey organisms. While the effect of competition to the juvenile fish food base can be intricate, it has been noted that survival rates for nestlings of some species of marine birds have been highly correlated with the size of pollock year classes. For piscivorous seabirds nesting on the Pribilof Islands it has been shown that in years of above average pollock year class strengths productivity appears good. However, in years with low numbers of age one pollock, nestling survival is reduced. Since the size of pollock year classes has varied greatly in recent years while the spawning stock has not, it appears that there is no strong spawner-recruit relationship for pollock. Therefore, harvesting pollock within ABC is not expected to deplete stocks and adversely affect pollock recruitment, and thereby, the food base for the birds. Actually, harvesting pollock and other groundfish within ABCs may lead to lower competition for the food base since harvesting of surplus adult pollock and other groundfish would reduce their prey requirements. It must be emphasized, however, that diets of seabirds other than those on the Pribilof Islands are poorly known and effects of groundfish harvests are therefore more difficult to predict.

Similar to several species of pinnipeds, breeding populations of marine birds, particularly kittiwakes and murres, have apparently declined over the past decade. Unfortunatley, no specific data are available to relate these apparent declines to prey availability or to other factors.

Physical Impact as a Direct Result Of On-bottom Fishing Practices

Under this alternative an additional 400,000 mt of groundfish could be harvested. Depending on the species, this harvest could entail certain combinations of trawls (on-bottom and mid-water), longlines, and pots. Only the bottom trawl has been identified as a gear type that impacts the bottom. It may cause abrasion of the bottom as it is pulled along, killing or injuring any animals and plant life that may have been in its path. Most bottom trawls are also equipped with rollers, or bobbins, that protect the trawl from damage, but which may also kill or injure animals and plant life. The actual severity of such impacts are not known, but are largely believed to be insignificant over the long term, given a capacity of the ecosystem to repair itself. It is not possible to estimate the additional impact caused by potential additional harvests of 400,000 mt.

6.3.3 Alternative 3: Set the upper end of the OY range equal to the sum of the annual estimates of ABC.

Effects under this alternative are believed to be similar to those anticipated under Alternative 2. In most years the EY/ABC estimates should sum to levels within the range specified in Alternative 2 (see Table 6.1). However, in some years it is possible that the OY may be greater under this alternative than the current OY limit of 2.0 million mt or the proposed 2.4 million mt, but this would be a result of above average levels of abundance in one or more of the species in the groundfish complex.

Alternative 3 sets the upper limit of OY directly to the current productivity of the groundfish resource. Under the other options, OY could exceed EY/ABC since OY is not specifically linked to EY/ABC and can be established anywhere in the present (1.4-2.0 million mt) or proposed (1.4-2.4 million mt.) ranges. Under Alternative 3 OY cannot exceed the level of harvest estimated by ABC; however, the OY can still be set at less than maximum levels for socioeconomic considerations.

One major difference in this alternative is the lack of a specified upper limit on OY. How high OY could range is only limited by the condition of the groundfish resource. For the near term EY/ABC for the groundfish resource is expected not to exceed 2.0-2.2 million mt (see Table 6.1.). However, it is possible that potential yield could increase to higher levels at some future time. Analysis of long term pollock yield suggests that MSY yield from this species alone may eventually be 2.2 million mt. Since pollock represents approximately 80% of the total groundfish catch, the anticipated upper limit on OY as set by ABC is believed to be about 2.6 million mt.

If the estimates of surplus production accurately account for natural mortality from bird and mammal predation, then setting the upper end of OY to the sum of ABCs should not adversely affect those animals. Alternative 3 could actually better protect bird and mammal populations than Alternative 2 since OY could not be set at 2.4 million mt unless justified by estimates of ABC. This alternative would also afford better protection to groundfish, birds, and mammals than the status quo if the sum of ABCs drops below 2.0 million mt.

Other impacts of this alternative should be similar to those discussed under Alternative 2.

6.3.4 Alternative 4: Set the upper end of the OY range equal to the sum of the annual estimates of ABC or to 2.0 million mt, whichever is less.

Effects under this alternative should be no different than those described under the status quo (Alternative 1) if the Council continues its reluctance to set harvest levels above EY/ABC. Since 1977 the OY has been set roughly equal to EY, or has been constrained at 2.0 million mt when EY has exceeded that value. If, however, the Council were under pressure to allow harvests above ABC, then this alternative would limit their ability to do so, thereby affording additional protection to groundfish, birds, and mammals. Given the current status of the groundfish stocks, however, EY is expected to equal or exceed 2.0 million mt for the near future; therefore, the more restrictive portion of this definition for OY is not expected to be implemented. If, however, ABCs do fall below 2.0 million mt, then similar benefits to the environment should accrue under this alternative as those outlined under Alternative 3.

6.4 Socioeconomic Impacts

6.4.1 Alternative 1: Status quo. Maintain the upper end of the OY range at the current level of 2.0 million mt.

Maintaining the upper limit on OY at 2.0 million mt may result in loss of revenue in years when the potential yield is in excess of 2.0 million mt. Under the current OY limit potential harvests of 248,000, 188,000 and 199,000 could not be taken in 1984, 1985, and 1987, respectively. The reduction of yield to the current upper OY limit resulted in possible revenue losses of $34.4, $29.1, and $30.9 million, based on a current average ex-vessel price of $155/mt, in 1984, 1985, and 1987, respectively. The actual losses in revenue could be higher or lower depending on the species that are excluded from harvest by the OY limit.

6.4.2 Alternative 2: Increase the upper limit of the OY range to 2.4 million mt.

The primary socioeconomic impact of increasing the OY range to 2.4 million mt. will be the increased revenues available to fishermen and processors from the additional 400,000 mt of OY which is equal to $62 million at an ex-vessel price of $155/mt. Again, actual revenue is dependant on the species included in the 400,000 mt increase in the OY limit.

An increase in the OY limit could possibly have an adverse effect on fishermen and processors through decreases in prices brought about by an additional 400,000 mt of fish. A 400,000 mt addition to the harvest translates into 120,000 mt of finished product at a 30% recovery rate. At these levels however, it is not likely that the additional harvest would have much impact on price structure since the increase is only a small fraction of the world whitefish supply.

An increase in OY may attract additional vessels into the fishery which might not enter the fishery under the current OY limit. If OY remains at or near the upper limit additional vessels will not have a negative impact on vessels currently fishing. However, when OY decreases to lower levels in the range there is no mechanism for removing the increased fishing effort and the lower amount of fish available will have to be shared among more vessels and, as a consequence, individual vessel revenues will be reduced due to the presence of additional vessels. This, however, is a risk inherent in any open access fishery and is not simply attributable to an increase in OY.

6.4.3 Alternative 3: Set the upper end of the OY range equal to the sum of the annual estimates of ABC.

The socioeconomic impacts of this alternative are expected to be similar to those of Alternative 2. However, this alternative would produce greater flexibility which would allow OY to be set at higher levels then the 2.4 million mt. limit of Alternative 2. If the groundfish resources rose to a point that harvests in excess of 2.4 million mt could be taken it would be possible to utilize all of the harvestable surplus and prevent the loss of harvest and revenues as caused in recent years by other limits to OY.

6.4.4 Alternative 4: Set the upper end of the OY range equal to the sum of the annual estimates of ABC or to 2.0 million mt, whichever is less.

In the foreseeable future the socioeconimc effects of this alternative are expected to be the same as those outlined for the status quo (Alternative 1) since the ABCs should equal or exceed 2.0 million mt. Thus, annual losses in potential revenue on the order of $30 million can be expected compared to allowable harvests under Alternative 3. If, however, the sum of annual estimates of ABC decrease below 2.0 million mt, then socioeconomic effects are also expected to be similar to those under the status quo (Alternative 1) since OY has historically been established equal to ABCs up to a limit of 2.0 million mt. Therefore, no socioeconomic effects relative to the status quo are anticipated, unless under the status quo, and contrary to past performance of the Council, OY is established above ABCs when ABCs sum to less than 2.0 million mt.

7.0 PROHIBIT POLLOCK ROE-STRIPPING

7.1 Description of and Need for the Action

Walleye pollock currently is processed into a suite of products including roe, fillets, surimi, and headed/gutted forms. Pollock roe is a particularly high value product that, during certain times of the year, can be obtained from females caught in spawning condition. Most operations that yield roe do so while producing other products, but some operations utilize only the roe, particularly during intense fisheries at the height of the spawning season (late January through March). By processing only the roe and subsequently discarding the carcasses, processing vessels can increase their total throughput of fish. Roe-stripping, however, has an estimated recovery rate of 3% to 4% (from females only) whereas fillet, surimi, and headed/gutted products have estimated recovery rates of 20% to 65% of all fish caught. Although stripping for roe may constitute an attractive short-term economic use of the resource, there is concern that roe-stripping without a concurrent use of the flesh constitutes unnecessary waste and should therefore be prohibited.

Since vessels choosing to process for roe only may be able to process an estimated three times the number of fish per unit time than vessels that also process the flesh, there is also concern that JVP apportionment will be consumed that much faster during an early part of the year. This would preclude other use of pollock at later times of the year for surimi and fillet production. Now that demand for joint venture apportionment greatly exceeds the supply, competition within the "olympic" or "common pool" system has intensified and the proportion of the processing fleet practicing roe-stripping may increase. Specific concerns of U.S. harvesters fishing for Japanese joint venture partners center around the potential of several large Korean surimi processing ships to process approximately 400-500 tons of pollock each per day during roe-stripping operations, as opposed to a more normal rate of 200-300 tons per day. Two major issues addressed in this analysis are: (1) considerations of waste, and (2) possible redistribution of catch among foreign nations, and therefore their U.S. partners, participating in the joint venture fishery.

The concept of "waste" is critical to an analysis of the roe-stripping issue. Given that surimi and other processing options do not utilize the entire fish, it is not reasonable simply to characterize the entire unused portion of roe-stripped fish as wasted. Although roe-stripping recovers only about 4% of the whole fish, other accepted processes recover 20%, resulting in a difference between only 96% and 80% of the body unused. Moreover, often much of this remainder is processed as fish meal, and therefore not "wasted", although apparently a smaller percentage is processed into fishmeal during roe-stripping operations. Reasonably, waste is defined not in absolute terms but in relative terms, even though the perspective may either be biological or economic in nature.

Possible effects of an intensified fishery early in the year, presumably caused by the "common pool" JVP apportionment and perhaps accentuated by roe-stripping, are also discussed in relation to yield and reproduction of pollock stocks. The discussion is general because there is no well established spawner-recruit relationship for pollock, and yield per recruit estimates are difficult to obtain without more information on the intensity of early-year harvests in relation to monthly growth patterns of pollock.

Based upon our analysis described below, it appears that as much as 27,000 mt of pollock may have been processed for roe only by Korean JV partners in 1986 and perhaps 40,000 mt by Japanese partners. There are no estimates of possible increased incidence of roe-stripping in 1987 over that estimated for 1986; however, given the more intense nature of this year's fishery some increase should be expected.

7.2 The Alternatives

Four major alternatives are analyzed to address pollock roe-stripping. The first alternative is the status quo, where there is no regulatory constraint on roe-stripping and discard of carcasses. The second alternative is a prohibition of pollock roe-stripping in joint venture fisheries. The third alternative is a prohibition of roe-stripping in both JVP and DAP fisheries (support of this alternative should lead to consideration of a similar amendment to the Gulf of Alaska groundfish FMP). The fourth is a semi-annual division of the annual JVP apportionment for pollock, proportional to historical catch trends, which will not prohibit the stripping of roe, but will limit targeting on fish during spawning seasons.

7.2.1 Alternative 1: Do nothing - status quo.

Under the status quo roe-stripping and discard of carcasses is not prohibited.

7.2.2 Alternative 2: Prohibit pollock roe-stripping in JVP fisheries.

This alternative would prohibit joint venture processors from discarding carcasses after processing only the pollock roe. Such a prohibition would prevent the discard of males and the stripped carcasses of females, requiring that the flesh be further processed into a useable form such as fillet, headed/gutted, or surimi products. This prohibition would not apply to domestic processors.

7.2.3 Alternative 3: Prohibit pollock roe-stripping in both JVP and DAP (all DAH) fisheries.

This alternative would prohibit all roe-stripping (discard of males and stripped females) of pollock, by both domestic and foreign processors. This alternative would more comprehensively address the wastage issue, and would anticipate the transition of pollock fisheries to total domestic utilization. To be truly comprehensive, however, a DAP prohibition would also have to be incorporated into the Gulf of Alaska FMP.

7.2.4 Alternative 4: Establish a semi-annual JVP apportionment schedule.

Under this alternative annual JVP apportionments would be divided into semi-annual limits proportional to historic catch trends. Such a system would allow continued roe-stripping but could be used to limit future targeting of the fishery solely on spawning fish. This could help mitigate a severe proportional increase in wastage, protect pollock stocks from potential overharvest of spawning fish, and prevent an accelerated "race-for-fish" from

Table 1. Alternative 4: Approximate monthly JVP harvests of pollock in the Bering Sea (expanded from monthly JVP harvests in 1986), and application to annual JVP of 1 million mt.

Month	Percent of annual harvest (%)	Amount of harvest (mt)	Semi-annual harvest quota (%)
Jan	0	0	
Feb	10	100,000	
Mar	25	250,000	
Apr	15	150,000	
May	0	0	
Jun	0	0	50
Jul	15	150,000	
Aug	15	150,000	
Sep	10	100,000	
Oct	10	100,000	
Nov	0	0	
Dec	0	0	50
Total	100	1,000,000	100

preempting a summer/fall surimi fishery, while allowing some short-term profit maximization via roe-stripping. Table 1 outlines percent monthly JVP pollock harvest levels from 1986 and tonnages based on a total apportionment of 1 million mt. A semi-annual JVP apportionment based upon such a schedule would provide for 50% of the harvest to occur during January through June and 50% during the rest of the year. Such a breakdown divides the annual joint venture pollock fishery into two equal components: (1) a spring roe fishery, and (2) a summer and fall surimi/fillet fishery.

7.3 Biological and Physical Impacts

There is no quantitative information specifically detailing the amount of discard associated with roe-stripping operations. Neither the NMFS foreign fisheries observer program nor industry reporting requirements account for discard after fish have been delivered. The estimates used for this analysis are, therefore, based upon assumptions derived from an informal survey of industry complemented by agency fishery statistics.

Prior to 1980 the harvest of pollock was predominantly by the Japanese and most of the annual catch was concentrated during the months June-September, outside of the roe season (Table 2). Since 1981, joint venture harvests have increased, recently exceeding foreign harvest levels, and beginning in 1987 there will be no further foreign apportionment of pollock. The monthly distribution of JV harvest has shifted toward earlier portions of the year. In fact, just between 1985 and 1986 there has been a substantial shift in targeting toward February and March (Table 3). Reports for spring 1987 indicate that JV catch rates have exceeded 10,000 mt per day, capturing over 70% of the annual JVP apportionment during the first quarter, which may result in harvest of the JVP apportionment well before the end of the year.

There has been a similar shift in the emerging DAP fishery between 1985 and 1986 (Table 3a), however there was a slightly opposing shift in the declining foreign fishery (Table 3b). Currently there appears to be no roe-stripping by DAP processors, but in the future similar conditions of intense competition and a "race-for-fish" may precipitate DAP roe-stripping. The present targeting of JVP and DAP pollock fisheries early in the year is likely to continue due to higher aggregation of pollock during the spawning season, an initial "race-for-fish" within the "olympic" apportionment scheme for JVP, as well as a possible selection toward roe-bearing fish. Implications of the high daily catches for early 1987, due to increased JVP processing capacity, include an accelerated "race-for-fish" and possibly a greater incentive for particular countries or operators to capture higher proportions of the quota via the high processing rates for roe-only.

Certainly not all fish captured during the spawning season contain sufficient roe content (not even all females) to warrant a roe-only fishery and not all fish processed for roe are discarded without coincident use of the flesh. However, based upon recorded JVP catch distributions for 1986 and assumptions regarding catch, processing and recovery rates (Tables 4 and 5), estimates of discard are derived in Table 6 for JVP-Korea and JVP-Japan. Only the discard of unused carcasses, and possibly the targeting of harvests on spawning fish, are considered under environmental impacts; redistribution of JVP among foreign nations and their U.S. partners is presumed not to affect the environment.

Table 2. Average monthly proportion of annual pollock harvests by Japan in the Bering Sea/Aleutian Islands for 1971-1980. (Low, L., pers. comm.)

Month	Percent annual harvest (%)
Jan	2.4
Feb	3.1
Mar	5.8
Apr	7.5
May	7.8
Jun	10.7
Jul	17.2
Aug	17.7
Sep	14.9
Oct	7.0
Nov	3.8
Dec	2.2
Total	100

Table 3. Monthly JVP harvests of walleye pollock in the Bering Sea/Aleutian Islands, 1984-1986. (PacFIN)

Month	1984 (mt)	1984 %	1985 (mt)	1985 %	1986 (mt)	1986 %
Jan	52	.0	86	.0	836	0.1
Feb	515	0.2	1,878	0.5	45,178	5.4
Mar	28,805	12.2	48,258	12.8	185,789	22.1
Apr	43,003	18.1	58,715	15.6	102,885	12.2
May	1,668	0.7	6,450	1.7	19,168	2.3
Jun	32,110	13.5	25,380	6.7	47,955	5.7
Jul	73,822	31.1	116,899	31.0	149,775	17.8
Aug	44,278	18.7	70,640	18.7	144,303	17.2
Sep	12,381	5.2	42,298	11.2	78,228	9.3
Oct	329	0.1	5,137	1.4	46,876	5.6
Nov	46	.0	1,798	0.5	13,000	1.5
Dec	0	0.0	0	0.0	6,429	0.8
	237,009	100.0	377,539	100.0	840,422	100.0

Table 3a. Monthly DAP harvests of walleye pollock in the Bering Sea/Aleutian Islands, 1984-1986. (PacFIN)

Month	1984 (mt)	1984 %	1985 (mt)	1985 %	1986 (mt)	1986 %
Jan	0	.0	23	0.1	6	.0
Feb	0	0.0	151	0.4	6,136	12.9
Mar	4	0.1	9	.0	3,881	8.1
Apr	188	2.6	89	0.2	8,401	17.6
May	41	0.6	1,033	2.6	3,838	8.1
Jun	0	0.0	970	2.4	3,970	8.3
Jul	88	1.2	981	2.5	5,169	10.8
Aug	823	11.3	7,451	18.8	3,547	7.4
Sep	90	1.2	5,680	14.3	5,975	12.5
Oct	372	5.1	18,619	46.9	2,991	6.3
Nov	1,145	15.7	1,085	2.7	3,366	7.1
Dec	4,561	62.4	3,579	9.0	378	0.8
	7,312	100.0	39,670	100.0	47,658	100.0

Table 3b. Monthly TALFF harvests of walleye pollock in the Bering Sea/Aleutian Islands, 1984-1986. (PacFIN)

Month	1984 (mt)	1984 %	1985 (mt)	1985 %	1986 (mt)	1986 %
Jan	15,477	1.7	14,816	1.8	16	.0
Feb	66,838	7.2	16,098	2.0	5,864	1.7
Mar	15,491	1.7	18,730	2.3	8,225	2.3
Apr	5,488	0.6	1,500	0.2	1,215	0.3
May	22,140	2.4	4,260	0.5	3,470	1.0
Jun	83,579	9.0	43,657	5.3	36,229	10.3
Jul	144,471	15.5	127,979	15.6	79,591	22.5
Aug	143,348	15.4	151,692	18.5	90,594	25.6
Sep	157,321	16.9	132,892	16.2	74,689	21.1
Oct	102,758	11.0	137,905	16.8	26,876	7.6
Nov	99,638	10.7	94,803	11.5	20,627	5.8
Dec	76,441	8.2	76,940	9.4	5,943	1.7
	932,990	100.0	821,272	100.0	353,339	100.0

Table 4. Assumptions of JVP-Korea pollock processing for the Bering Sea (based on 1986 harvest levels), with two scenarios of roe-stripping.

Product	Percent of harvest (%)	Amount of harvest (mt)	Recovery rate (%)
Block	25	63,371	100
H/G	25	63,371	65
Fillet	5	12,674	20
Surimi	45	114,068	20
	100		
Subtotal	90	253,485	51
Scenario 1			
Roe only Females	50	13,511	4
Discard Males	50	13,511	0
	100		
Subtotal	10	27,021	2
Scenario 2			
Roe & H/G Females	50	13,511	69
Discard Males	50	13,511	0
	100		
Subtotal	10	27,021	35
TOTAL Scenario 1	100	280,506	47
TOTAL Scenario 2	100	280,506	50

Table 5. Assumptions of JVP-Japan pollock processing for the Bering Sea (based on 1986 harvest levels), with two scenarios of roe-stripping.

Product	Percent of harvest (%)	Amount of harvest (mt)	Recovery rate (%)
Block	0	0	100
H/G	0	0	65
Fillet	0	0	20
Surimi	100	465,070	20
	100		
Subtotal	92	465,070	20
Scenario 1			
Roe only Females	50	20,000	4
Discard Males	50	20,000	0
	100		
Subtotal	8	40,000	2
Scenario 2			
Roe only Females	50	20,000	4
Fillet Males	50	20,000	20
	100		
Subtotal	8	40,000	12
TOTAL Scenario 1	100	505,070	19
TOTAL Scenario 2	100	505,070	19

7.3.1 Alternative 1: Do nothing - status quo.

Based upon assumptions derived from 1986 data (Tables 4 and 5), it appears that an upper value of 67,021 mt of pollock was processed for roe-only in the Bering Sea (Table 6). Using further assumptions regarding the amount of the carcasses processed into fishmeal after other production operations, we estimate a possible "worst-case" discard of about 176,610 mt of pollock biomass in the 1986 JV pollock fishery, compared to an estimated 135,376 mt discard if roe-stripping had been prohibited. Therefore, roe-stripping may have accounted for an additional 41,234 mt of discard, an increase of 30%.

Given that processing of pollock for surimi and other accepted product forms already accounts for discard of tens or hundreds of thousand mt, that processing of other groundfish contributes substantial discard, that the incidental catch of prohibited species must also be discarded, and that catches of under-sized or otherwise undesirable fish are often discarded, it appears that the incremental discard of pollock from roe-stripping operations may not be significant compared to other practices common to the groundfish fishery in the Bering Sea. There is no indication that discard causes environmental harm, except in confined areas; it is arguable that discard is actually beneficial since it returns at least a portion of the organic material back into the ecosystem that produced it.

If roe-stripping operations tripled, and other aspects of the fishery remained the same, increased discard attributable to allowing roe-stripping would total an estimated 123,703 mt, causing an 91% increase of discard for the entire JVP pollock fishery over that if roe-stripping were prohibited. Although it is not possible to project the increase in JVP targeting on roe-only, the rapid decline of JVP apportionments anticipated in the next few years should preclude the increased wastage of large tonnages of useable pollock by joint ventures.

Targeting of pollock harvests on spawning fish could conceivably have an effect on subsequent reproduction of the population. However, recruitment to the Bering Sea pollock stocks appears to be relatively independent of spawner abundance and may be much more influenced by environmental conditions. No explicit density-dependent or spawner-recruit relationships have been identified for pollock, therefore no explicit impact can yet be attributed to increased proportional harvest of spawning fish. Harvesting of fish earlier in the year does, however, preclude further growth of those fish during summer after which total yield would be higher. Since current yield per recruit relationships used in status of stocks determinations are based upon historic harvest patterns, substantial changes to those harvest patterns may affect the estimates. A preliminary yield per recruit model is presented in Chapter 2 (DAP priority) which tends to confirm intuition that high catch rates early in the year do forfeit subsequent increases in biomass of the stock gained during summer feeding and growth.

7.3.2 Alternative 2: Prohibit pollock roe-stripping in JVP fisheries.

As outlined under Alternative 1, the estimated increase of discard in the JVP pollock fishery attributable to allowing roe-stripping is an estimated 41,234 mt. No identifiable environmental impacts have been associated with this increase, therefore no explicit benefit is expected to accrue to the environment due to a prohibition of roe-stripping.

Table 6. Estimates of JVP pollock harvests, processing and discard related to roe-stripping in the Bering Sea (based on 1986 harvests and assumptions outlined in Tables 4 and 5).

Scenario	JV partner	Season	Harvest (mt)	Percent of harvest (%)	Average recovery rate (%)	Amount unprocessed (mt)	Percent unprocessed used for fish-meal (%)	Amount of discard (mt)	Percent of harvest dis-carded (%)	Increase in discard over that with roe-stripping prohibition (mt)	(%)
Roe-stripping:	Korea	Roe	27,021	10	2	26,481	20	21,184	78		
Roe-only females		Rest of year	253,485	90	51	124,208	75	31,052	12		
Discard males				100							
		Subtotal	280,506	36	46	150,688		52,236	19	17,874	52
	Japan	Roe	40,000	8	2	39,200	20	31,360	78		
		Rest of year	465,070	92	20	372,056	75	93,014	20		
				100							
		Subtotal	505,070	64	19	411,256		124,374	25	23,360	23
	BOTH	Roe	67,021	9	2	65,681	20	52,544	78		
		Rest of year	718,555	91	31	496,264	75	124,066	17		
		TOTAL	785,576	100	28	561,944		176,610	22	41,234	30
Roe-stripping	Korea	Roe	27,021	10	35	17,564	20	14,051	52		
Roe H/G females		Rest of year	253,485	90	51	124,208	75	31,052	12		
Discard males				100							
or		Subtotal	280,506	36	49	141,771		45,103	16	10,741	31
	Japan	Roe	40,000	8	12	35,200	20	28,160	70		
Roe-only females		Rest of year	465,070	92	20	372,056	75	93,014	20		
Fillet males				100							
		Subtotal	505,070	64	19	407,256		121,174	24	20,160	20
	BOTH	Roe	67,021	9	21	52,764	20	42,211	63		
		Rest of year	718,555	91	31	496,264	75	124,066	17		
		TOTAL	785,576	100	30	549,027		166,277	21	30,901	23
Prohibit JV roe	Korea	Entire year	280,506	36	51	137,448	75	34,362	12	0	0
stripping	Japan	Entire year	505,070	64	20	404,056	75	101,014	20	0	0
	BOTH	TOTAL	785,576	100	31	541,504		135,376	17	0	0

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7.3.3 Alternative 3: Prohibit pollock roe-stripping in both JVP and DAP (all DAH) fisheries.

The transition of the Bering Sea pollock fishery from joint ventures to wholly domestic operations portends the greatest potential discard due to roe-stripping, but it is as yet not possible to anticipate the incidence of roe-stripping that will occur under DAP fishing. If, however, as much as 30% of an annual allowable DAP harvest of 1.2 million mt were processed for roe-only and the rest processed for surimi or fillets, then the roe fishery would account for 282,240 mt of discard compared to the remainder of 168,000 mt of discard for a total discard of 450,240 mt. If roe-stripping were prohibited for DAP fisheries, then discard from DAP surimi and fillet operations on 1.2 million mt would equal 240,000 mt. Therefore the increase in discard attributable to 30% roe-stripping in DAP pollock fishing in the Bering Sea, above that for a fishery with no roe-stripping, would be 210,240 mt, an 87.6% increase. As outlined under Alternatives 1 and 2, it is not possible to identify environmental impacts associated with such an increase in discard, particularly when it is compared to other discards associated with the Bering Sea groundfish fishery.

7.3.4 Alternative 4: Establish a semi-annual JVP apportionment schedule.

Given that the discard of roe-stripped pollock under this alternative would likely be intermediate between that under Alternatives 1 and 2, we cannot identify any environmental impact. Prevention of capturing more than 50 percent of the harvest during the first half of the year would, however, likely maintain higher yield per recruit.

7.4 Socioeconomic Impacts

There is concern that roe-stripping constitutes an unconscionable waste which violates policy considerations of full use of fish resources. Under our analysis of environmental impacts we identified incremental increases in the discard of flesh from roe-stripping versus other forms of processing (Table 6). In Table 7 the amounts and percent decrease in processed products (other than fishmeal) attributable to roe-stripping are also calculated. Under our worst-case scenario, approximately 20,508 mt of product were foregone in 1986 compared to a total of 244,773 mt of product (not including roe) that would have been produced under a roe-stripping prohibition, resulting in an 8% presumed forfeiture of product other than roe (and fishmeal). Since this forfeiture of product affected the foreign supply of product, a prohibition of roe-stripping can be expected to cause an increase in the amount of foreign pollock products competing with those produced domestically.

National Standard #5 of the FCMA requires that "Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measures shall have economic apportionment as its sole purpose". Given that this analysis has identified no environmental impacts attributable to roe-stripping, the major issue remaining, in addition to an increase of foreign-produced JV pollock products, is the redistribution of JVP harvest between foreign processors, and consequently their U.S. partners. Such economic considerations obviate the requirements of the national standard. This amendment proposal is not a

Table 7. Estimates of JVP pollock harvests, processing and production related to roe-stripping in the Bering Sea (based on 1986 harvests and assumptions outlined in Tables 4 and 5).

Scenario	JV partner	Season	Harvest (mt)	Percent of harvest (%)	Average recovery rate (%)	Amount of product (mt)	Percent of product (%)	Decrease in product from that with roe-stripping prohibition (mt)	(%)
Roe-stripping: Roe-only females Discard males	Korea	Roe	27021	10	2	540	0		
		Rest of year	253485	90	51	129911	100		
				100			100		
		Subtotal	280506	36	47	130451	58	-13308	-9
	Japan	Roe	40000	8	2	800	1		
		Rest of year	465070	92	20	93014	99		
				100			100		
		Subtotal	505070	64	19	93814	42	-7200	-7
	BOTH	Roe	67021	9	2	1340	1		
		Rest of year	718555	91	31	222925	99		
		TOTAL	785576	100	29	224265	100	-20508	-8
Roe-stripping: Roe H/G females Discard males	Korea	Roe	27021	10	35	9322	7		
		Rest of year	253485	90	51	129911	93		
				100			100		
or		Subtotal	280506	36	50	139233	59	-4526	-3
Roe-only females Fillet males	Japan	Roe	40000	8	12	4800	5		
		Rest of year	465070	92	20	93014	95		
				100			100		
		Subtotal	505070	64	19	97814	41	-3200	-3
	BOTH	Roe	67021	9	21	14122	6		
		Rest of year	718555	91	31	222925	94		
		TOTAL	785576	100	30	237047	100	-7726	-3
Prohibit JV roe stripping	Korea	Entire year	280506	36	51	143759	59	0	0
	Japan	Entire year	505070	64	20	101014	41	0	0
	BOTH	TOTAL	785576	100	31	244773	100	0	0

policy consideration or a comprehensive approach to the management and control of waste in the groundfish fishery, but only addresses a small component of that waste attributable to one fish processing procedure.

The following regulatory analysis of alternatives will address fishery costs and benefits; reporting costs; administrative, enforcement, and information costs and benefits; impacts on consumers; and redistribution of costs and benefits associated with an increase in foreign production of products other than roe and the possible redistribution of JV pollock delivered to participating foreign nations.

7.4.1 Fishery Costs and Benefits

It is apparent that increased effort earlier in the year is caused by a race for the JVP apportionment, moreso than by a preference for roe. Although the Japanese roe market has been strong in recent years, it has weakened in 1987 due to oversupply and a higher proportion of lower quality product. In contrast to the roe market, however, the demand for fillets has been strong due to a worldwide shortage of cod. Given a strong fillet market and the weakened roe market, it is doubtful the roe-stripping is the impetus behind the large increase in effort thus far in 1987.

Alternative 1: Do nothing - status quo.

In 1987, JV harvesters are being paid a constant price for pollock deliveries, regardless of the eventual product form. Therefore, it does not appear that allowing or prohibiting roe-stripping would have any impact on total revenue paid to domestic fishermen except to the extent that foreign processors factor the higher value of roe into their initial price negotiations with their U.S. partners. There is the possibility, however, of an allocative effect between vessels fishing for different countries or companies. If the practice of roe-stripping increased, the quota could be reached earlier, therefore U.S. harvesters delivering to roe-stripping processors could enjoy increased deliveries at the expense of those catcher vessels which delivered to processors that do not strip the carcasses.

Domestic processors may be benefitting from the practice of roe-stripping by foreign processors, since those countries are forfeiting a commensurate amount of other pollock products which could compete with domestic production. In 1986, Japan exported 76,356,000 pounds of pollock products to the U.S. at a value of $113,132,000. Korea exported 47,795,000 pounds at a value of $36,157,000. Potential increases in production and consequent export of foreign products caused by a prohibition on JVP roe-stripping are discussed below.

Alternative 2: Prohibit pollock roe-stripping in JVP fisheries.

JV harvesters are paid a set price for pollock regardless of eventual processing form. Therefore, no explicit impact is expected to those harvesters due to a roe-stripping prohibition if the full JVP apportionment is taken during the year. If, however, such a prohibition were to preclude taking of the full apportionment, then U.S. harvesters would suffer a loss equal to the value of the remaining uncaught balance. Given the demand for JVP apportionments, and our estimates that only 67,000 mt is stripped, it does not appear likely that a prohibition of roe-stripping would prevent full harvest of the JVP apportionment.

Domestic harvesters and processors could, however, be indirectly affected by a roe-stripping prohibition due to increases in the amount of other pollock products processed and marketed by the foreign companies. While any final market impact is uncertain, Table 7 provides estimates of the amount of pollock products that may have been foregone due to the practice of roe-stripping; scenarios are presented for both Korea and Japan. Assuming that Japanese production is 100% surimi there would have been an estimated additional 7,600 or 3,200 mt of surimi produced in 1986 if roe-stripping had been prohibited. Given that 27,000 mt of surimi was exported from Japan to the U.S. in 1986 out of their total production of 400,000 mt, then we can expect that approximately 6.75% of Japanese-produced surimi may be exported back to the U.S. Such a percentage of 7,600 or 3,200 mt of added surimi from JVP pollock might, then, add 513 or 216 mt to exports to the U.S. These added exports would have an estimated value of $1,996,000 and $824,000, respectively, equalling 3.6% or 1.5% of the total 1986 Japanese exports of surimi to the U.S. For Korea, similar calculations yield an estimated possible increase of 1082 mt of pollock fillet blocks exported to the U.S. at a value of $1,569,000. This increase is equal to 5.9% of total 1986 Korean pollock fillet block exports to the U.S.

If the prohibition of roe-stripping results in an increase in pollock products exported to the U.S., the effect would be an outward shift in the supply curve of these products. Other things remaining constant, this increase in supply would cause a decrease in the U.S. market price. If the U.S. firms face higher costs (i.e., labor, insurance), they may find it uneconomical to produce pollock given the reduced price and therefore cut back production. If this occurred, domestic producers would suffer an economic loss. The extent of that loss is dependent upon a number of unquantifiable factors, most importantly the domestic demand and foreign and domestic supply elasticities.

In contradistinction to possible negative impacts associated with increased foreign exports to the U.S., a prohibition of JV roe-stripping may benefit an apparently growing U.S. export of pollock roe. In 1985, domestic exports of roe totalled 144,540 pounds at a value of $166,322 to Japan. In 1986 this quantity increased over ten-fold to 1,772,727 pounds worth $2,282,444. It appears possible for the domestic industry to fill any market void created by a reduction in pollock roe produced by Korea and Japan from U.S. waters.

Alternative 3: Prohibit pollock roe-stripping in both JVP and DAP (all DAH) fisheries.

Impacts of this alternative would include those specified under Alternative 2 plus any additional impacts resulting from prohibiting roe-stripping by domestic processors. At this time we are not aware of any domestic operations that strip for roe-only and discard carcasses. However, eventually, limits to DAP roe-stripping may alter both the amount of roe produced and exported from the U.S. as well as the U.S. supply of other product forms.

Alternative 4: Establish a semi-annual JVP apportionments schedule.

If the shift in effort toward the beginning of the year continues, domestic harvesting and foreign processing vessels will complete their pollock operations early in the year, and would have an extended period during which they would need to find alternative activities. Under Alternative 4, the pollock harvest would be split into two distinct components, requiring harvesters and processors to find alternatives for two, presumably shorter, periods of the year. If the January-June quota is taken before the end of June, then joint venture operators would need to seek alternative activities. The foreign processing vessels could cease processing until the second apportionment is released, move into the "doughnut hole" and process pollock harvested by their own fishing vessels, or reduce their number of processing vessels and thus overall effort in the Bering Sea.

Domestic harvesters would also need to seek alternative activities during periods after the JVP apportionments are captured. Options include participation in other joint ventures or fishing for domestic processors. Availability of domestic harvesters could benefit domestic processors attempting to increase DAP utilization of the pollock resource, however it is not clear that domestic harvesters can wait for domestic processing to come on line.

7.4.2 Reporting Costs

Alternatives 2 and 3 will require some additional reporting costs to maintain records of discard associated with roe-stripping. Currently no records are required for amounts of fish discarded in the groundfish fishery, and no reporting is required specifically related to discard associated with roe-stripping.

7.4.3 Administrative, Enforcement, and Information Costs and Benefits

Again, all of the alternatives other than the status quo will involve additional costs. Additional administration will be required to track the occurrence of discard or to administer seasonal apportionments and subsequent closures, if necessary. Enforcement efforts would be intensified to focus on a minor portion of the fishery, specifically segregating the discard of fish from one portion of the processing sector (roe-stripping) from all of the others. Information costs will increase to keep track of data associated with observations of discard or seasonal harvests, or to enforce seasonal closures if necessary.

7.4.4 Impacts on Consumers

As the quantities of pollock affected by roe-stripping are currently small relative to the total landings, consumers should not be affected by a prohibition on roe-stripping in terms of quantities of product available or prices paid. However, if worldwide demand for pollock roe increases enough to direct larger and larger amounts of pollock to a roe fishery which discarded carcasses, then consumers could witness a decrease in the amount of fillets and surimi. This decrease could not be recaptured unless consumer demand for fillets and surimi increased the prices of these products. Such a redistribution of pollock processing would be eliminated or reduced under Alternatives 2, 3, and 4.

7.4.5 Redistribution of Costs and Benefits

Under the status quo, increased effort in the pollock fishery will increase the amount of pollock harvested and processed earlier in the year. Although we cannot estimate the loss in total revenue paid to joint venture harvesters, there may well be an increasing redistribution from those vessels that fish for processors which do not strip for roe to those harvesters for processors that do strip and discard carcasses.

Under Alternative 2, vessels fishing for processors that did not strip for roe would gain in relation to those harvesters fishing for processors that previously stripped roe. There might also be increased product exported back into the U.S. due to increased utilization of pollock carcasses for fillets and surimi by foreign processors, although such an increase would not likely be substantial.

Alternative 3 would likely include those redistributional effects of Alternative 2 plus any effects of a roe-stripping prohibition on the domestic processing sector.

It is not clear what redistributional effects Alternative 4 would have; however, given that the proposed semi-annual apportionment schedule is based on the 1986 JVP harvest levels, the redistributional effects should be even less than those expected under the status quo.

8.0 EFFECTS ON ENDANGERED SPECIES AND ON THE ALASKA COASTAL ZONE

None of the alternatives would constitute actions that "may affect" endangered species or their habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 on the final actions and their alternatives will not be necessary.

Also, for the reasons discussed above, each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Zone Management Program within the meaning of Section 307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

9.0 FINDINGS OF NO SIGNIFICANT ENVIRONMENTAL IMPACT

For the reasons discussed above, neither implementation of the status quo nor any of the reasonable alternatives to that action would significantly affect the quality of the human environment, and the preparation of an environmental impact statement on the final action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

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Date

10.0 COORDINATION WITH OTHERS

The Bering Sea/Aleutian Islands Groundfish Plan Team consulted with representatives of the Alaska Department of Fish and Game, National Marine Fisheries Service, members of the Scientific and Statistical Committee and Advisory Panel of the Council, and members of the academic and industrial community. Particular acknowledgment is given to Lew Queirolo, Regional Economist (NMFS) and Joe Terry, Economist (NWAFC).

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